THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. XCIII. No. 2226.] LONDON, JANUARY 9, 1906. [58TH YEAR. PRICE 6d.

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OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.

SAFETY GAS-MAIN STOPPER,

FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS.

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GAS-LEAK INDICATORS.

FOR GROUND USE. FLUSH BOXES ETC. HIGHLY SENSITIVE. LONG-RANGE.

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WITH ALL LATEST IMPROVEMENTS.

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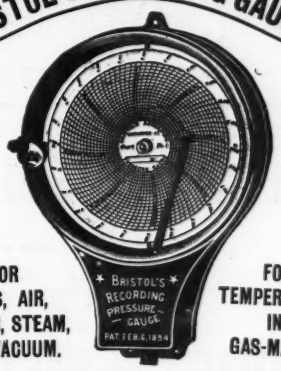

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FOR TEMPERATURE IN GAS-MAINS.

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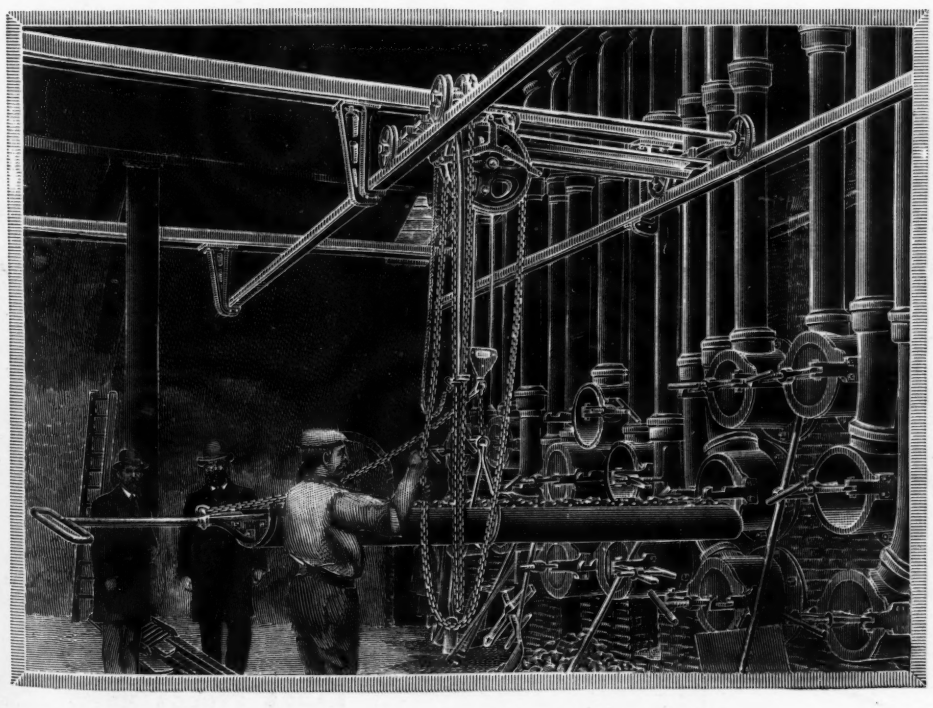

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Annual Yield per Retort increased many thousands of feet.

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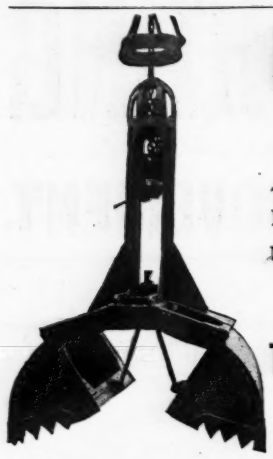

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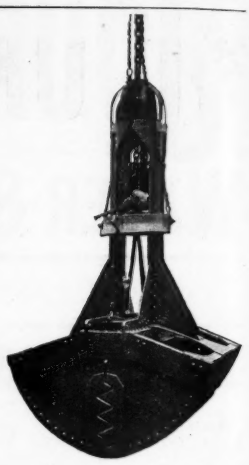

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WORKED WITHOUT ANY CONNECTIONS AT ALL

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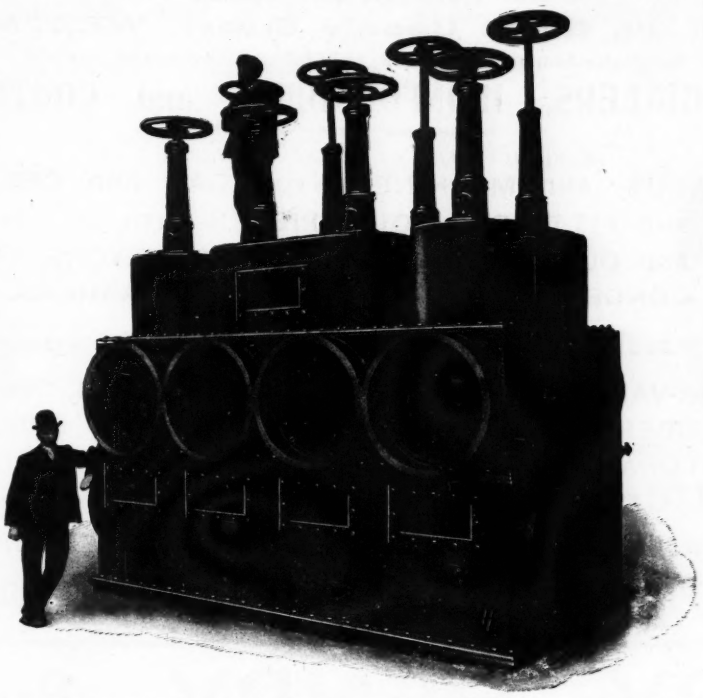

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Patent Coin Prepayment Gas-Meters

Fitted with Detachable Attachments.

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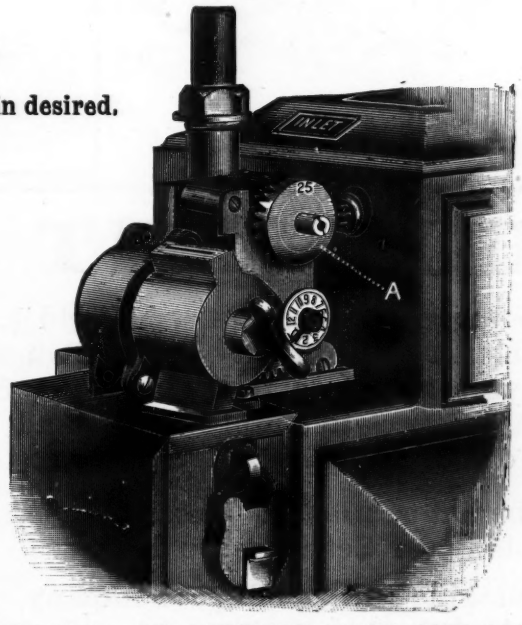

Change of Price effected by simply removing Crown Wheel "A" and replacing same with another Wheel.

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RETORTS AND FITTINGS, MOUTHPIECES WITH SELF-SEALING LIDS.
IMPROVED COAL AND COKE HANDLING PLANT, CONVEYORS, AND ELEVATORS.
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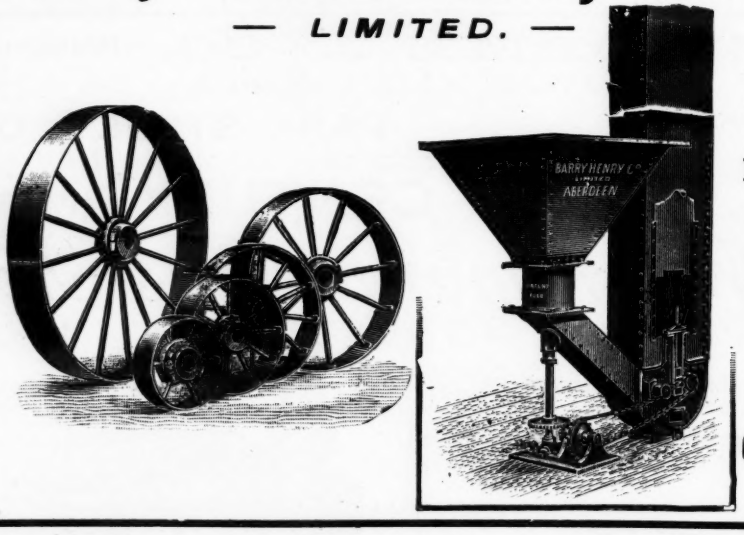

Specialities:
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Conveyors,
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AND
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IMPORTANT NOTICE.

It is the practice of the "Gas World" to publish from time to time analyses of the accounts of Gas Undertakings in this Country. A number of such analyses appeared in the issue for September 16, and they show that at Fenton, Longton, Rotherham, and Tipton, some of the highest results were obtained in Gas Made and Coke Sold.

It may be interesting to Gas Engineers to learn that at these four places Winstanley's Settings are in use.

The Winstanley Speciality Company, Newton Chambers, Cannon Street, Birmingham.

WELSBACH LIGHT

(PATENTED)

Fig. 35. 100 c.p.

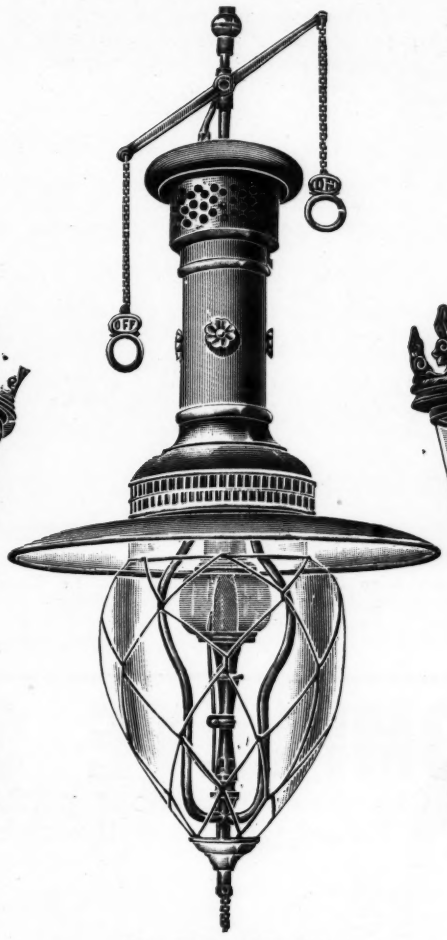

Fig. 607. 600 c.p.
Self-Intensifying.

Fig. 35a. 300 c.p.
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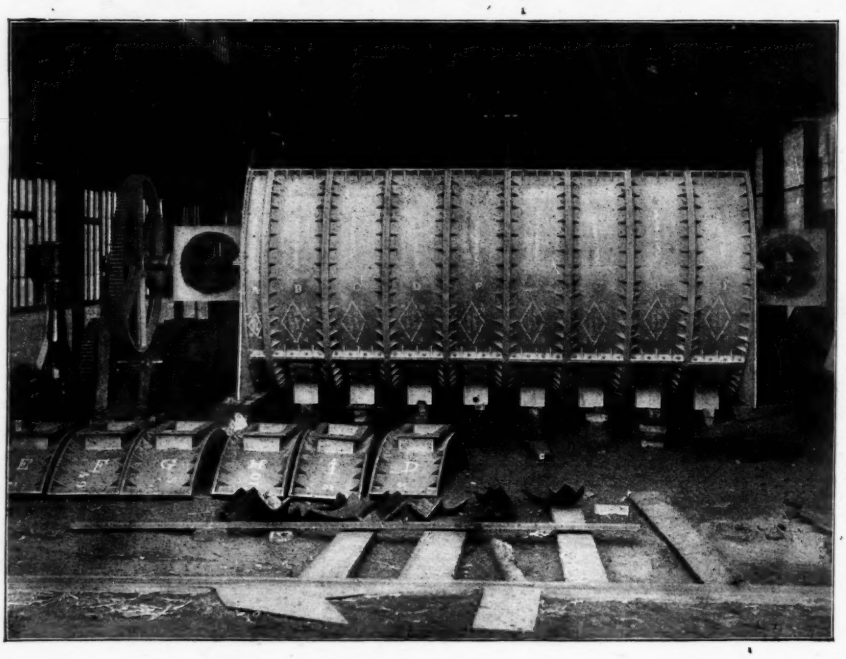
LARGE AREA OF WASHING SURFACE.

REMOVAL OF THE WHOLE OF THE AMMONIA AND A LARGE PERCENTAGE OF CO_2 AND SH_2.



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BUNDLES EASILY ACCESSIBLE FOR CLEANING.

"Whessoe" Rotary Washer-Scrubber (H. Kirkham & Chandler's patent). **Capacity 1,500,000 Cub. ft. per diem.**
One of Two Machines supplied by us to a Foreign Gas-Works, photographed in our shops during course of construction.

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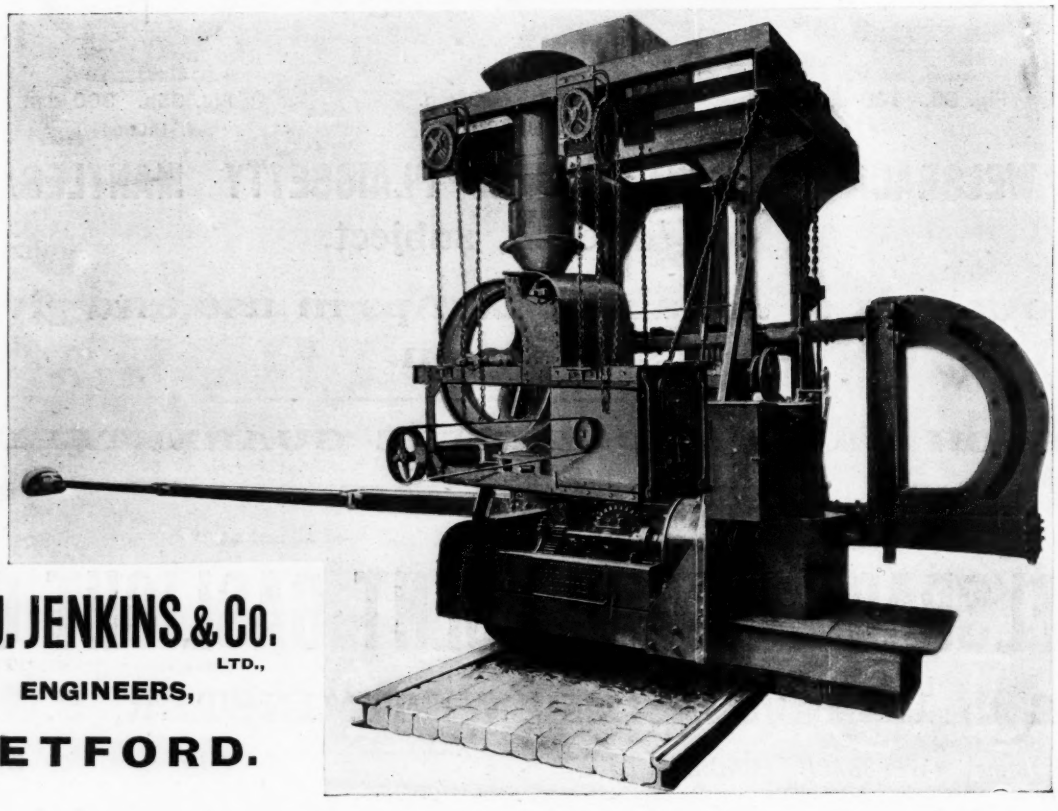
THE COMPLETE STOKER.

Both Discharging and Charging Operations performed by one machine, for Retorts 20 feet through.



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THE "BRAY" INCANDESCENT GAS

BURNER

WITH INSIDE BYE-PASS

AND THE

"BRAY" PATENT GAS ADJUSTER.

The most economical results can be obtained by using a "Bray" Burner, fitted with the "Bray" Adjusting Screw. It enables the burner to be used with any quality or pressure of gas.

OUR CATALOGUE CONTAINS ALL PARTICULARS.

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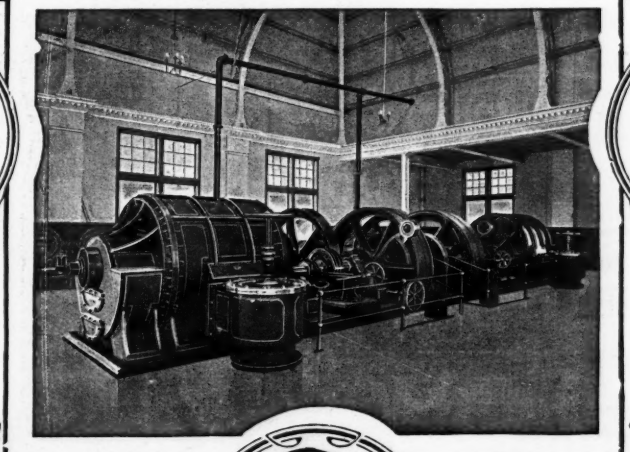

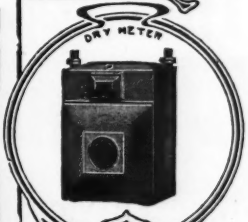

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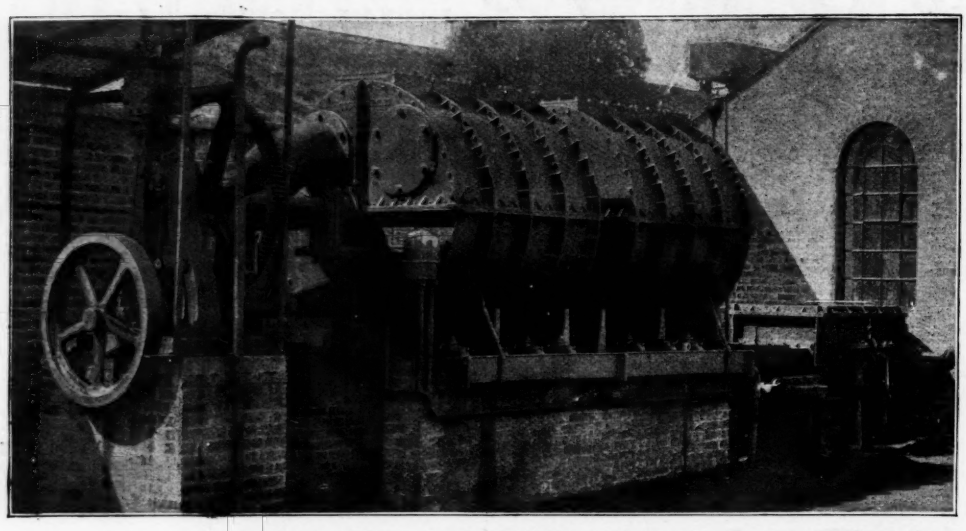

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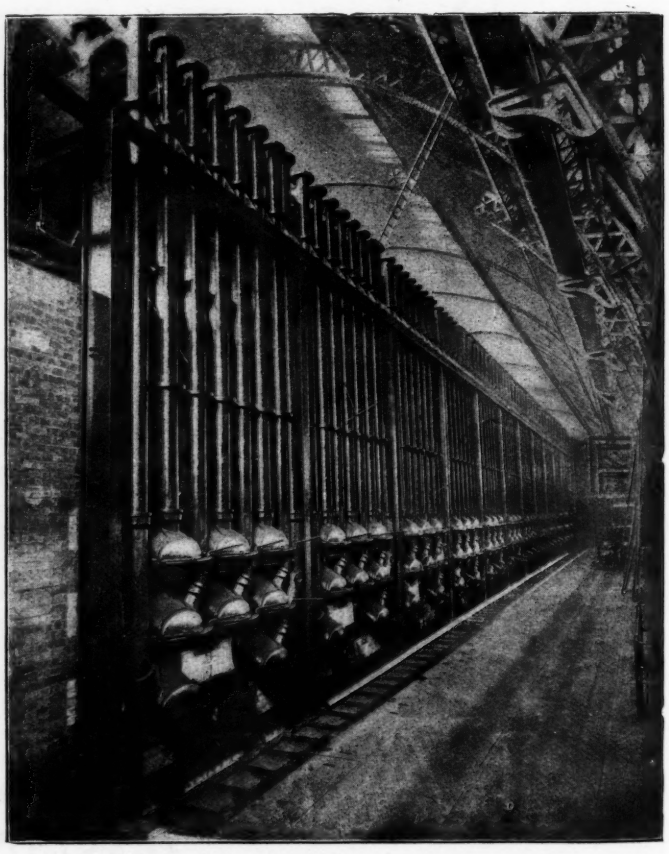
Inclined Retort Installation, With Hot-Coke Conveying Plant.



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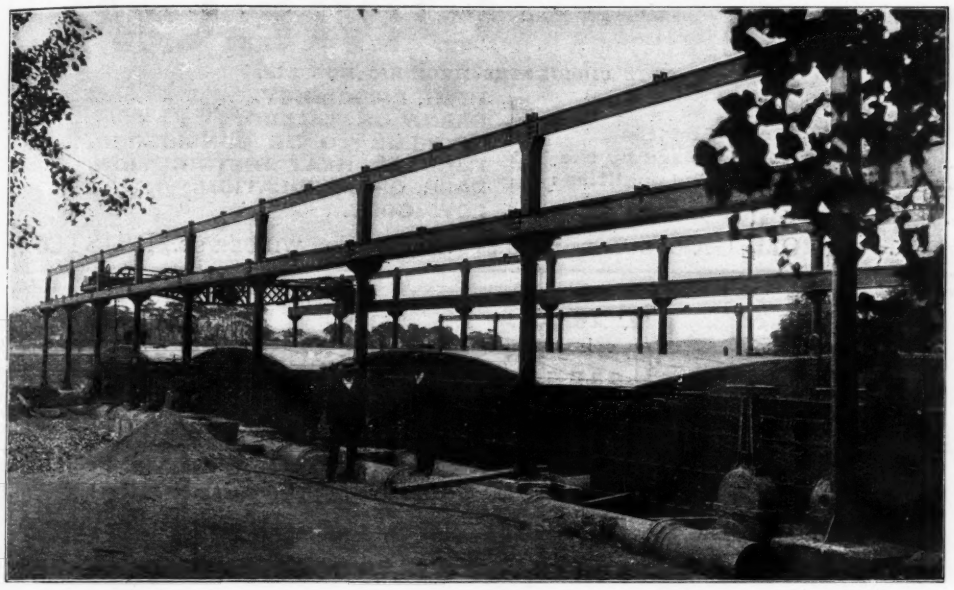

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Four Purifiers, 30 ft. square, 20-inch Connections, also Columns and Superstructure for Roof.

Order placed March 30
Work finished July 18
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Each Mantle Ring bears the Reg. No. 427,544.

All Mantles stamped "STAR."

Otherwise none genuine.

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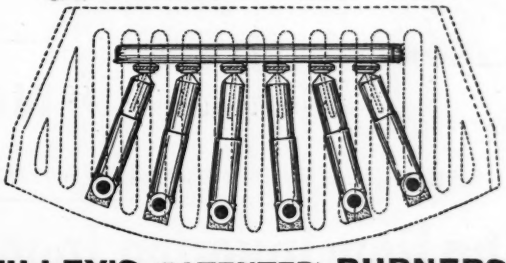
FIT GAS-FIRES TO COAL GRATES
QUICKLY AND AT SMALL COST.



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Can be Adjusted to Shape of Grate and Gas Pressure *in situ*.

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EVERITT'S
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As a Naphthalene Remover.

The Exhaust Steam heats up the Tar and the Gas, and enables it to remove the maximum amount of Naphthalene. By removing the Tar, no Naphthalene is carried forward to the Scrubbers, except in strong and thorough combination with an **EXCESS** of light hydrocarbons, so evenly distributed and always sufficient in quantity to prevent the action of ammonia on the phenols liberating the Naphthalene dissolved by them.

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PRICES FROM 15/-.

DO YOU KNOW

18

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THE "OMEGA"

IT CIRCULATES HYGIENIC HOT AIR,

And it is Recognized by the following qualities:

HIGH EFFICIENCY.
EASILY INSTALLED.
NO FLUE TO BE CONSIDERED.
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WE HOLD THE STOCK. THE OMEGA ODOURLESS GAS STOVE CO., LTD., WILDER ST., BRISTOL.

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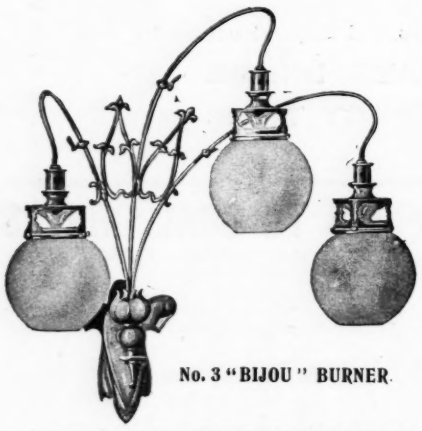

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COMBINED WITH
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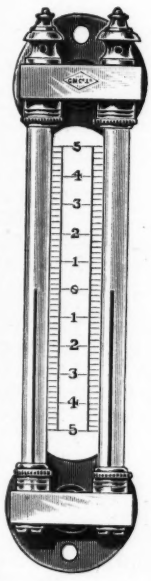

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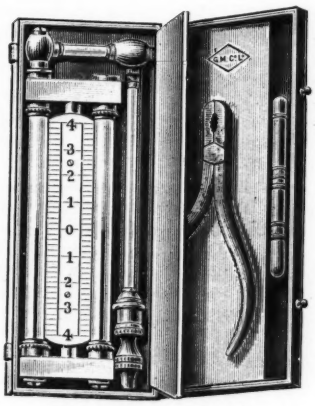
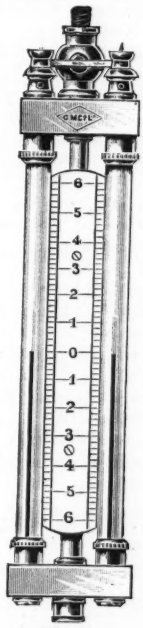


Inspector's Pocket Gauge.



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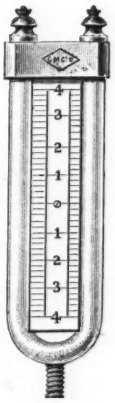

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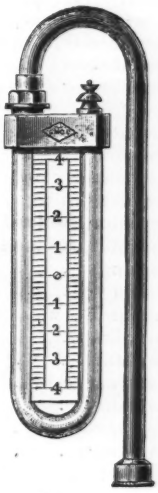

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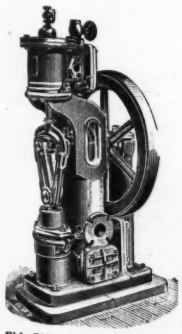

Fig. 705. "SINGLE RAM" STEAM-PUMP.

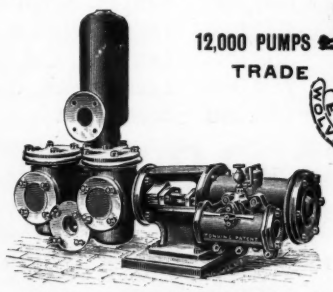

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

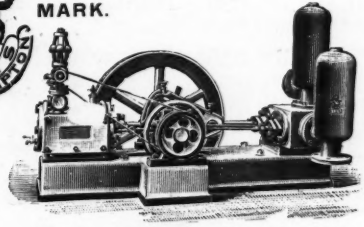

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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Brussels—Ville (Second)	750,000	Liége, Belgium	1,000,000	Staines	600,000
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Hampton Court	500,000	Budapest, Hungary	50,000	Stockport (3rd)	400,000
Lea Bridge (3rd)	400,000	Swindon	300,000	Agram, Croatia.	200,000
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VOL. XCIII., No. 2226.—TUESDAY, JANUARY 9, 1906.

EDITORIAL NOTES—GAS, &c.

The Future of Gas Testing.

THE revised notification of the Metropolitan Gas Referees which we were enabled to publish last week, and to which a brief reference was made in these columns, is (as we then suggested) possessed of no ordinary interest. It is, indeed, of the highest importance, because it indicates what is practically a new departure in gas testing for the Metropolis, and also inaugurates easier times for the hitherto greatly harassed suppliers of gas within the large area to which it relates. At last the odious system of penalty testing has been brought within what may be termed reasonable limits, such as have all along been accepted as sufficient for the control of the gas supply in nearly every other part of the United Kingdom. For the first time, consequently, there is a very near approach to the uniformity in gas testing which was clearly contemplated by the Gas-Works Clauses Act of 1871, but which special legislation for the Metropolis—to say nothing of the interpretation put upon such legislation by the Referees—has hitherto persistently set at naught.

As regards the latter, it is instructive, but at the same time somewhat melancholy, to reflect how greatly this institution of the Gas Referees has fallen from its former high estate. It was founded with high hopes, and with the concurrence of the Companies, with the avowed object of assisting in the development of improved methods of manufacture and application of gas, in order that the very best that Science could devise or suggest might at all times be at the command of the consumer. Control over the quality and purity of the gas was to a certain extent made subsidiary to this great object; at all events, the stipulation that at least one Gas Referee was to have "practical knowledge and experi- "ence in the manufacture and supply of gas," was regarded as a sufficient guarantee that no arbitrary or impracticable condition would be imposed on the Companies. For a time, "all went merrily as a marriage bell." Almost the first act of the newly appointed Gas Referees was to institute an inquiry into the "Construction of Gas-Burners," and the application of the principles which regulate the development of light from coal gas, "in the manner most advantageous and "economical for the public." Their report on this highly important subject, although containing but little that was actually new, did excellent service by authoritatively directing the attention of all concerned to the enormous waste which was at that time resulting from the use of bad burners. Later, the Gas Referees were at least instrumental in devising the only practicable method of purification from sulphur compounds, now happily rendered unnecessary by greater enlightenment on the subject. Their utility, however, as improvers or reformers seems to have ended with the claim set up by one of their former number—Mr. R. H. Patterson—to have been the discoverer of the method, and the proceedings that ensued therefrom. Since the retirement shortly afterwards of Mr. F. J. Evans, not one of their number has ever possessed the stipulated qualifications of practical knowledge and experience in the manufacture and supply of gas. They consequently lost touch with the requirements of the gas industry; and their functions have been for a long time practically confined to devising methods of gas testing, in which they have shown themselves bent upon the fulfilment of the very strictest letter of the law, without regard to consequences. We refer particularly to the test which was prescribed for sulphuretted hydrogen under cover of an Act passed at a time when there was not the remotest idea that such a severe test could ever be imposed or even thought of. That, however, with other like extremes, has now gone by the board.

A very much more reasonable spirit—no matter how or by what means inspired—breathes in the notification just issued; and it is with much pleasure we are able to acknowledge, on the further consideration that we have been able to give to it, that it deserves to rank in all respects, save one, as an authoritative exposition of the art of gas testing. The exception which we feel bound to take is to the retention of the table photometer. It was perhaps only to be expected that the Gas Referees would not readily discard an apparatus of their own devising; but they must surely see that there is no longer any advantage to be gained from its use. It was an admirable arrangement so long as the way to get equality of light in the photoped was to vary the gas consumption. Now, however, that the fixed illumination has given way to a fixed rate of consumption, it becomes necessary to move either the gas light or the screen, and of the two the latter is surely the least objectionable. Why then retain the somewhat elaborate and, certainly in its now prescribed form, undesirable table photometer, when a simple bar photometer with moveable screen will so much better answer the purpose? We fear that the decision of the Gas Referees on this point will prove a stumbling-block in the way of the adoption of a uniform system of gas testing, and that they may, in this particular respect, have lost the chance of giving a lead. We are not, however, quite without hope that a little further experience with the altered arrangement will satisfy them of the desirability of reverting to a simple bar photometer, and thus coming in line with the general feeling of gas engineers on the subject. This would render unnecessary the departure in the notification from at any rate the letter of the law, where it is prescribed that the rate of consumption is to be reduced below the statutory rate of 5 feet per hour "if the gas is so rich that it cannot be "made to burn at such rate without tailing above the chimney "or smoking, or if the burner cannot be pushed far enough "away to produce equality of illumination in the photoped." It is true, the occasion is one that will not probably occur often; but a similar provision—except that the rate of consumption is to be increased instead of diminished—is made with regard to the testing with the flat-flame burner. It is surely desirable, if by any means possible, to avoid these departures from the letter if not the intention of the Act.

We congratulate Professor Boys upon the acceptance by his colleagues of the improved calorimeter which he has devised, and which was described and illustrated in our issue for the 19th ult. It appears to be an instrument admirably adapted for the purpose, and, whatever may be said with regard to the tests of illuminating power with a flat-flame burner, it is certain that the tests for calorific value which it is intended henceforth to make will be watched with ever-increasing interest.

The Inevitable Way.

No one can read the review of the Gas Bills for the coming session without being arrested by the straightness of the road that gas is taking to the lower illuminating powers. There can be no doubt that the destiny of gas is sealed—that never again, excepting by the uneconomical and careless, will it be required in general lighting for its unaided luminosity; that the giving of light will only be through the influence exerted by the combustion of the gas upon some body external to its own constitution, just as to get light by electricity the energy is fed to the carbons of the arc lamp or to the filament of the incandescent lamp. The character of the gas that will efficiently perform this service is the gas that is sufficiently good for all the multifarious other purposes for which it is now employed. We need not go farther back than the session of 1891; and we find that from then up to 1900, the rule in Gas Acts was an illuminating power of 15 candles—the exceptions to the rule being very occasional cases of higher powers. In the year 1900, however, there was only one Gas Act in which anything but 15 candles was specified as the standard illuminating power; and that exception was the epoch-making Act of the South Metropolitan Gas Company, which was passed after the keenest of parliamentary struggles with those preaching the progressive doctrine, but who failed to recognize progress when put before them in the clearest

light. Some people within the industry thought the struggle was not worth the gain. That, however, was immediately afterwards; the tendency of opinion to-day is set severely to the quarter to which the Act of 1900 directed it. True, there existed gas undertakings at the time which were supplying gas of 14-candle power; but there were no companies who, in the decade preceding the year 1900, had been in Parliament, and had left it with anything less than a 15-candle obligation resting upon them. The South Metropolitan Act commenced the shattering of the parliamentary illuminating power fetish; and the next year there were four Companies who had their illuminating power standard fixed at 14 candles. In the next session or two, there was still variation; but last year 14 candles was very generally adopted. And what of the Bills promoted by Companies for the ensuing session? We believe we are correct in saying that of them all Mirfield is the only concern asking for an illuminating power of 15 candles. All the others are specifying 14 candles or—and this is the trend—13 candles. We pointed out last week, in commenting upon the Non-Statutory Companies' Bills, that of the five promoting Companies, four were asking for 14 candles, and one—the Truro—for 13 candles. The statutory Gas Companies who are in Parliament this year exceed the number in recent sessions, and they more than adjust the shortness in the first-comers for incorporation and statutory powers. Notwithstanding their number, we have only noticed the one Company exceeding 14 candles. The remainder of those asking for a variation of their illuminating power are all desirous of securing a standard of 14 candles, save three; and they—the South Suburban Company, the Epsom and Ewell Company, and the Watford Company—specify 13 candles. It is the inevitable way. Last year the South Suburban Company stood alone in asking for 13 candles. The Company, it is seen, will not do so in the approaching session.

In the present issue, we are only able, through the amount of contained interest, to deal elsewhere with a portion of the statutory Gas Companies' measures, and will therefore reserve until the review of their provisions is completed next week, comment on a few other of the salient features.

Suggestions for Gas Undertakings.

THE short article on electrolysis in last week's issue suggests further consideration, which may be of advantage to gas undertakings generally, if it succeeds in stimulating interest, and interest invigorates action. Two very important questions arise. The first is, Why are the Board of Trade so obdurate in the matter of granting to owners of underground pipes the further protection they desire against, and for the prevention of, electrolysis? The second is, Is not the time essentially opportune for commencing a very determined effort for securing the desired protection? The hostility of the Board of Trade to all suggestions emanating from other interests which in any way affect the practically untrammelled liberty of the electricity supply industry, has been of a vigilant order, and time has been when it was almost acrid in character. In respect of electrolysis particularly, the claims of gas and water undertakings to specific protection have from the outset been treated to official contempt; and therefore it is well to attempt to look beneath the surface for the reason for this attitude. The excuses for withholding the protective clause are flimsy to the extreme. As was argued last week, however good the Board of Trade regulations may be in regard to the installation of electrical systems, what is further required are the most effective means of enforcing obedience to those regulations, and of ensuring that the utmost precautions may be taken for preventing injury, by itinerant electric currents, to the distribution systems of other public services; and such means, we contend, are concentrated in the specific protection asked for, but so far in most cases denied, by the Board of Trade, backed by the distributors of electricity. If the Board's regulations are as efficacious as is claimed, then, as we have asked before, and now ask again, what particle of harm or wrong would be inflicted upon electricity undertakings by the concession of protection by Parliament to those who have been the occupiers of the subsoil of roads for many generations—long prior to the general distribution of electricity? There has never been any definitive answer to this question from either the Board of Trade or the electrical industry. On the assumption of the sufficiency of the regulations if fully and properly complied with, it could be only those who neglect them who would suffer. Then, *a fortiori*, the need for an effective inducement to prevent the dropping into laxity, or the winking at indifferent work on account of cheapness. Again therefore the question arises, Why the obstinacy of the Board of Trade?

The answer is difficult to give, unless it be that the electrical interests have had, from the outside, an influence upon the Board of Trade of a character that cannot tend to impartiality. We do not assert that it is so; but there may be an indication of a possible solution of the, as yet unaccountable, attitude of the Board. It was, as readers are aware, during the presidency of the Right Hon. Gerald Balfour at the Board of Trade that the policy of the department in regard to the electrolysis question took such concrete form; and the policy was continued under the presidency of the Marquis of Salisbury. Hands may be held up in pious horror at an insinuation on our part that Presidents of a Government Department, being human, are nepotists, and may, like other individuals, be swayed in their view thereby. It so happens that Colonel Eustace J. A. Balfour, brother of Mr. Gerald Balfour, is Chairman of the St. James' and Pall Mall Electric Lighting Company and Deputy-Chairman of the London Central Electric Supply Company; and of both these Companies Mr. Sydney Morse is Solicitor. The same gentleman occupies a similar position in connection with that great Corporation the British Electric Traction Company, who have large interests in a hundred or more undertakings. Then there are Sir William Preece and Major Cardew, both late Government officials, and now professionally engaged in the electrical industry; but, as late Government officials, is it not possible they may have the willing ear of present-day officials? We only state these facts to show the possibility of, though it does not affirm, past outside influence upon the policy of the Board in this particular matter. Far be it from us to impugn the honour in any way of the gentlemen named; the only point we wish to make is, that it cannot conduce to unbiassed arbitrament on questions such as this of electrolysis if influence is allowed to be brought to bear, through direct or indirect ways, by outside commercial or professional interests.

The antagonism notwithstanding, certain, but admittedly rare, success has been achieved on this electrolysis question by an immediate appeal to Parliament on Electricity Bills; and a prominent instance was that by various Gas Companies on the Administrative County of London Electric Power Company's Bill last session. If that measure had gone through, the appearance of the clause in it would have constituted such a clear defiance by Parliament of the departmental attitude on the question, that thenceforth it would have been extremely difficult for officialism to have maintained its position. But the Bill failed owing to want of time, and has been reintroduced for the coming session. But like all the fresh promotions projecting grandiose schemes for London and other parts of the country awaiting consideration by the new Parliament, the resuscitated Bill is absolutely silent on the question of electrolysis.

This brings us to our second question—whether the present is not an opportune time for making a determined effort to break down this persistent bureaucratic opposition to protective legislation where electricity is concerned? We think it is, and we want to impress upon gas undertakings that there is no time to be lost in the matter. Every session confirms new schemes, and every passing year sees fresh ones brought into being. The projects that have now been proposed for London are of a far-reaching nature, and will serve as models in the Provinces hereafter. Our readers do not need to be told what great influence legislation affecting London has in the way of precedent in regard to the Provinces; and if an electrolysis clause is put into any one of the Power Bills for London that Parliament may be pleased to endorse, it will be an effective precedent for all time to come. It was, notwithstanding the Board of Trade efforts, regarded by Parliament as a proper thing to introduce a clause into the unfortunate Administrative Company's Bill last session; thus reaffirming previous decisions of Parliament on the point. That, so far as it went, was an important gain; and it is a consideration that should weigh now in promoting and stimulating action in the matter in the coming session. In the Metropolitan Electric Supply Bill, Parliament inserted a clause; and it will not do to hesitate in following up with deliberation these successes.

There are other considerations. There is a new President at the Board of Trade; and it may be the hope of some of

our readers that Mr. Lloyd-George may long continue there, especially if he declines to follow the lead of Mr. Gerald Balfour in this matter. However that may be—whether in the new Parliament the present occupant remains in office or a Conservative President succeeds him—we hope that he or his successor will admit that there is anyway a *primâ facie* case, in connection with this electrolysis and other questions affecting electricity supply, for cutting the bonds of red-tapeism, in order that simple acts of justice to other interests may not be longer refused. It is also possible that the whole of the Power Bills for the Metropolitan area may be referred to a Royal Commission, especially if the Liberal Party are returned to power. The President of the Local Government Board (Mr. John Burns) is not going to sit inertly by, and see the London County Council Bill snuffed out by the House of Lords. To avoid any risk of such disaster, he will in all probability get the whole matter shelved for a time by the simple process of a Royal Commission. We hope that he will; and he is just in the position to do it—more especially with the lately-made addition to the Progressive force in the House of Lords. If a Commission is appointed, it will be well for the gas industry to be heard, and to be well prepared for the purpose. Without going further into this matter now, we certainly think that a very good case has been made out for our contention that the present time is a particularly favourable one for making a powerful stand over this subject of protection for underground pipes against electrolysis.

While on the one subject that now especially requires parliamentary watchfulness and activity on the part of gas undertakings, it should also be urged that there must be no abating of opposition on the part of gas companies to the expensive and wasteful method of municipalities for creating new business through "free" wiring and fittings. Powers to adopt this system must be sedulously opposed, and particularly so the dangerous invention of the London County Council by which they purpose enabling the Metropolitan Borough Councils to ride roughshod over the ratepayers and the Borough Funds Act. We refer to the inclusion of the wiring and fittings powers in their Omnibus Bill for next session, after their repeated rejection by Parliament in previous sessions. By the means thus created, there is no necessity, as would be the case if each Borough Council promoted a Bill on its own account to obtain these powers, for the submitting of the Bill under the Borough Funds Act to the ratepayers in each borough. Thus the defensive power that ratepayers would otherwise have, if they took advantage of it, becomes a dead-letter; and the Radical doctrine that representation and taxation should go together is thus treated to contempt by those who most loudly proclaim its sanctity. Local authorities are sufficiently spendthrift now without giving them free passage to fresh, heavy, and largely unprofitable expenditure, without as much as doing the—unfortunately, in the past, too credulous—ratepayers the honour of saying, "By your leave." If the Electrical Contractors' Association did not take up a double attitude upon this question, but distinctly opposed all municipal speculation in this direction without conniving at it providing the work is done through contractors, it would be easy for a *liaison* to be arranged between them and gas companies in their opposition to the granting of these powers by Parliament. As it is, they part company on the road. In any event, so far as gas companies are concerned, they should offer a determined opposition to municipal wiring powers obtained in the dangerous and evasive manner referred to; and if they cannot secure the rejection of the wiring clauses, they should endeavour to get a proviso inserted to the effect that no borough should be allowed to put in force the powers thus obtained without previously getting the sanction of the ratepayers, in the manner, so far as practicable, prescribed by the Borough Funds Acts. In looking after protection in these matters, there is also the Northumberland clause to be borne in mind in connection with general trading in electricity by local authorities.

The Kerosene Lamp as a Standard of Light.

With Harcourt's pentane air-gas and standard lamp, no one will be prepared to say that finality has been reached in the matter of a standard of light; but few there are who will not be prepared to say that it is the most acceptable standard of light that has yet been proposed. The article, however, that a highly esteemed correspondent, Dr. A. H. Elliott, the Engineer-Chemist of the Consolidated Gas Company of New York, contributes to our columns to-day, shows that, in his quest for a simple and handy standard for works' photometry, he has arrived at the conclusion that he has discovered in the kerosene (paraffin) oil lamp not only that for which he has been seeking, but a standard that, as compared with the pentane lamp, "is fully as steady, is "much easier to adjust, and is far less dangerous." Had we not the pleasure of personal knowledge of Dr. Elliott, there would have been an inclination to regard his appraisement of the kerosene lamp as a veritable standard in much the same way that a father praises his own child—keeping in the background all those little faults that others look upon as almost, if not quite, countervailing the virtues. Oil-lamps with wicks have never so far been counted a success as standards of light by British photometrists who have had experience of the several forms used and proposed. In the "Carcel" lamp, burning refined colza, slight variations in the wick or chimney cause appreciable variations in light intensity; with the Keates lamp, consuming sperm oil, uniformity in the character of the flame was a trouble; and with the Hefner-Alteneck amyl-acetate lamp, the colour of the light (no less an authority than Mr. Dibdin told us many years ago) rendered it extremely difficult for various operators to agree, and, the tendency being towards white light from all artificial sources, the adoption of a dusky flame as a standard would be, in his opinion, a mistake.

Though reliability has not been a feature of oil-lamps as standards in the past, it is not a reason why even something on more simple lines than has been hitherto suggested should not be found to offer greater reliability. We cannot, however, suppose that it has been left to this, or the past, year of grace before kerosene has been brought under investigation for the purpose of a standard; but, with Dr. Elliott, we do not remember that any publication of information has been made of any such investigation. If there has been, it will be interesting to hear of it now. But meantime the work of Dr. Elliott must be held to be original, and on distinctly independent lines. The remarkable uniformity of readings, over months of trial, and under a great variety of conditions—such as after different periods of burning, and with observations by various expert and inexpert operators—commend the very clear exposition of the work he gives us, as well as the suggested standard, to the serious consideration of other photometrists. It was only for a fairly reliable works' standard that our contributor started his experiments with the kerosene lamp; and with him we can only express surprise at the trustworthiness and the uniformity, confirmed by frequent repetition, of the results that he obtained, without any specially devised means other than the care in regard to the trimming of the wick, and the screening off of the top of the flame. Experience in the ordinary use of kerosene lamps would have led us to fully expect that there were opportunities for so many errors to creep in that such consistency of result as we have presented to us by Dr. Elliott would hardly have been possible. But it must be that, with such an indefinite arrangement, it will be necessary—unless everything from the oil to the chimney is standardized—each time of (say) trimming, and before putting the lamp into use again for photometrical purposes, to test it against standard candles, and simply use it as a secondary standard. Dr. Elliott is now working at the screening of the light to produce a 10-candle flame; and it is remarked that he hopes to "produce an "oil-lamp standard fully equal to the pentane lamp." How near he has arrived at this point is seen by the last paragraph of the article. Under these circumstances, it may be there will eventually be development to conditions that will give results in which there will be confidence by the use of a defined grade of kerosene and a specified make of wick.

We will not enter here into the details that are so interestingly presented in Dr. Elliott's article. But in thanking him for making such a valuable contribution to a subject that is in this country at the moment a very live one, we must congratulate him on the successful results of his work to the stage that he has carried it. It has reached a point at which he will not be tempted to leave it; and of its progress we hope to hear. The work is sure to induce other photometrists to put Dr. Elliott's lucidly and freely stated information to the test; and whatever the result, it will be very instructive to receive for publication an account of the experiences.

American Views of Mr. Forstall's Method of Charging.

The paper read by Mr. A. E. Forstall, at the annual meeting of the American Gaslight Association, on "Methods of Charging for Gas," gave rise to a good discussion, which would probably have been prolonged had not the amount of business to be got through compelled the President to close the debate. We gave a fortnight ago a report of the remarks of the speakers in the first part of the discussion; and in another part of the "JOURNAL" will be found those made in the concluding portion, with Mr. Forstall's reply. The paper by this gentleman was the second he had submitted, and the fourth which had come up for consideration by the Association. The first was read by Mr. Walton Clark in 1891; the second by Mr. Forstall, seven years later; and the third by Mr. Frueauff, at the meeting in 1904. Mr. Clark dealt principally with the equity of charging for gas at a fixed price per 1000 cubic feet, whether for all the consumers or for those in certain classes, without regard to the differences in the cost of supplying them arising from the varied conditions under which the supply is taken. In his first paper, Mr. Forstall showed the effect Mr. Clark's system would have had if applied to the Company he was then managing. Mr. Frueauff dealt with the question on the basis of the system adopted by Mr. H. L. Doherty, and known by his name, in charging for electricity, in which a prominent place is given to the outlay incurred by a company to enable them to meet the maximum demand of the consumer. A special charge is made to cover this outlay. The proposals embodied in the first two papers were regarded on the other side of the Atlantic as impracticable. Those of Mr. Forstall are sufficiently fresh to obviate the necessity for reference to them.

Methods of Charging for Gas.

In his reply to the letter by Mr. Forstall on "Methods of Charging for Gas," Mr. Thomas Newbigging maintains the position he took up in his recent paper read before the Manchester District Institution of Gas Engineers. He denies that it is within the range of practical working that one man should be charged, and consent to pay, $5 for that for which his neighbour is called on to pay only $1·75. Whether the consumption is great or small, he argues, it is made up of units; and if the total of one consumer is less than that of another, so the total capital outlay to supply him is also less. Mr. Newbigging concludes by pointing out that he is opposed to discounts, either large or small, being allowed to certain consumers, even when their consumption is heavy. Where a discount is properly due, it should be a moderate one, strictly regulated in amount by the saving in outlay which the consumption secures.

Naphthalene.

The facile pen of Mr. William Young has been at work again, enriching our columns with further discussions of the problems associated with the prolific subject of naphthalene. There are two communications from him this week—the one in the form of an article, and the second a contribution to our "Correspondence" columns. In the article, Mr. Young discusses the investigations of Messrs. White and Clary—combating certain of their deductions, and giving support to the conclusions that Dr. Colman advanced in his recent masterly criticism of the work of the same investigators. In the letter, it will be found that Mr. Hanbury Thomas's instructive article on the experiences at Sheffield with naphthalene and with the Derby and Leicester processes provides scope for useful reflection by Mr. Young on several matters, but mainly on the subject of the effect of sudden as compared with slow cooling or condensation, and the question of the impossibility of there being complete immunity from naphthalene trouble on the application of an oil-washing system until the mains have, through the gradual effect of the oil-washing, been cleared of previous deposit. How far Mr. Young admits originality on the part of Mr. Bell and Mr. Colson, is disclosed in the final paragraph of the letter.

Vertical Retorts.

Reverting to Mr. Young's article to which attention is directed in the preceding note, it will be observed that in its closing paragraph, the author gives brief but independent testimony on the subject which Mr. Herring is discussing in his present communications to the "JOURNAL." Mr. Young also states that vertical retorts have been found to possess many advantages in the carbonization of shale for the production of paraffin oil. He concludes by saying: "Along with others, I have lately been giving consideration to the subject of carbonization and gasification of coal in modified forms of vertical retorts such as those I have long had experience in using in connection with the shale industry and I feel fairly confident that some good, practical trials of such modified forms as these arrangements will be found to be equally advantageous in connection with the gas industry." We hope that Mr. Young, as soon as he can conveniently do so, will give in these columns the benefit of his experience in this direction. His energy and love for research have carried him far, and have yielded generously of material benefit to the gas industry. We therefore hope for more. Mr. Herring's second article describing and illustrating one of the best forms of vertical retorts in use in the shale-oil fields will be published next week.

The Effects of Flueless Gas-Stoves.

A second article communicated by "E. D. W.," on "Flueless Gas-Stoves and their Effects on the Atmosphere of Rooms," is devoted to the consideration of carbonic acid in its various aspects. The author says there is an unreasonable prejudice existing in the lay mind against this gas; whereas its chief offence against animal life is that it is not oxygen, and that its presence usually (though not necessarily) means that the percentage of oxygen present in an atmosphere is diminished. He shows the effect that a condensing stove would have on the atmosphere of an unventilated room, and concludes with the remark that there will probably be considerable improvements in flueless stoves in the near future. Among these, he suggests, will perhaps be some method of taking up chemically—say, by lime—a larger portion of the carbonic acid produced.

Stoking Machinery for Horizontal Retorts.

There was a lively discussion at the meeting of the Midland Junior Gas Association last Saturday, after the reading by Mr. S. T. Smith, of Walsall, of a paper on "Some Types of Stoking Machinery for Horizontal Retorts." Mr. Smith dealt in a comprehensive manner with his subject; and he concluded by giving some figures with regard to the cost of carbonizing at Walsall by West's compressed-air machinery and the De Brouwer projector. He was, however, careful to point out that these figures were of little use for purposes of comparison, owing to the fact that in the former case all the work (down to the loading up of the coke) is done by machinery; whereas in the house where the De Brouwer charger is installed, the retorts are still drawn by hand, and the coke wheeled away. The advisability of adopting some kind of stoking machinery was not challenged; but the members had a good deal to say with regard to the advantages and disadvantages of the different forms, from their own particular point of view.

A Successful Assessment Appeal.

The Bradford Corporation have successfully repelled, by an appeal to the West Riding Quarter Sessions, an attempt on the part of the Keighley Union to substantially increase the assessment for poor-rate purposes of the portion of the water-works undertaking which is situated within the parish of Oxenhope. The Union sought to increase by about one-half the rateable value of property which had not in any way been altered or added to in the meantime; the reason advanced for this course being that hitherto "Keighley had been notoriously under-assessed, and a revaluation had been made in order to do justice to the ratepayers." By their decision, however, the Magistrates have held that, in this particular case at any rate, the Rating Authority failed utterly in their laudable desire "to do justice" to the ratepayers who were chiefly concerned—that is, the Bradford Corporation. In the course of the hearing it was explained how enormously the cost of the Thornton Moor reservoir had been increased by the difficulty of securing a suitable foundation. In fact, this trouble led to the abandonment of a project to construct a second reservoir. Storage for compensation water had thus been provided very greatly in excess of the requirements; and the total cost of the works was stated to have been so much that water from Thornton Moor was sold at Bradford at less than cost. It seems that the Union are disposed to carry the matter further; for application was made for a case to be stated "on the principle of the decision."

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 125.)

THE opening week of 1906 on the Stock Exchange was somewhat of a disappointment. It started on Tuesday with a great flourish. There was much show of activity, and prices were talked up; but the thing was overdone and forced beyond its intrinsic strength. The natural consequence was that it soon gave way, and the general tendency became dull and quiet, and prices fell flat. And thus matters went on until nearly the close of the week, when a rather better feeling supervened. The Money Market had something to do with it all, as the demand strengthened almost from day to day, though on Saturday the tension relaxed, and discount rates ruled firm. Business in the Gas Market was pretty fair on the whole, but the features of the day varied considerably; being at some times quite active, and at others dropping away into an inanimate state. But the tendency in point of values was quite satisfactory, quotations of undertakings both home and foreign showing improvement; while there was not one retrograde movement to note *per contra*. In Gaslight and Coke issues, the ordinary was in excellent favour and very active at times. On the opening day it was done once at 102½; but these figures were soon left behind, and the price advanced to 103⅞, with an improvement of a single point in the quotation. There was not much doing in the secured issues, and prices were only middling. A small amount of the maximum free was marked on Tuesday at 86¼, which seems an impossibility, and it was probably an "erratum" for the debenture stock. On Wednesday, the maximum marked 90; the preference changed hands at 110¾ free and 111; and the debenture was done specially at 86½. South Metropolitan was quiet; only four dealings being marked in it. Prices were unsteady; jumping down from 133¾ to 132. The debenture stock was busiest at figures ranging from 87½ to 88⅛. There were a few dealings in Commercials; but quotations were fiddled up and down in an unsatisfactory manner. Transactions in the 4 per cent. were marked at from 117⅞ to 118½; in the 3½ per cent. at 114¼; and in the debenture at 85¼ and 86. The Suburban and Provincial group exhibited their usual placidity, but were very firm. Alliance and Dublin old was done at 21, the quotation advancing a point; Bournemouth "B" at 17¼; Brentford old at 263 and 265; and British at 43½ and 43¾, with an advance of half-a-point in the quotation. The Continental Companies were also inactive. Imperial changed hands at from 234½ down to 233¼, Union was done once at 129, the top price, and European gained half-a-point in the quotation of the part-paid shares. Tuscan was done at 9⅝ and 9⅞, and the debentures were quoted *ex div.* at higher figures. Among the undertakings of the remoter world, Buenos Ayres was done at 12 9/16 and 12 23/32, Primitiva ordinary at 7⅛, ditto preference at 5 5/16 and 5⅜, ditto debenture at 97¾ and 98½, River Plate at 13 and 13⅛, and ditto debenture at 95½. Bombay was marked at 6⅞. Melbourne 5 per cent. advanced one point, and ditto 4½ per cent. two points. San Paulo debentures were quoted *ex div.* at an advance.

The closing prices are shown in our Stock and Share List on page 125.

ELECTRIC LIGHTING MEMORANDA.

The Parliamentary Programme—The "Tantalum" and the "Osmi" Lamp in Public Lighting—Where the Cost of Public Lighting has not been Raised—Plain Speaking at Colchester.

IT is an interesting programme that the electrical industry and would-be participants in that industry are presenting to Parliament for the coming session; and those whose harvest is reaped at Westminster, at the Parliamentary Bar or as electrical expert witnesses, will hail with pleasurable anticipation a list that in numerous of its lines carries the promise of contentious business. The great London Power Bills, if they are not relegated to the dim and distant future by the appointment of a Royal Commission, mean much work and much pay. There are several affecting the Provinces which will incite local authorities to look to the protection of their own particular preserves. There are also local Electricity Supply Bills from the Provinces, some of which are expected to be contested; and there are Bills which have "stowed" away among numberless other provisions clauses dealing with free-wiring, fittings, &c. The Electrical Contractors' Association, and we hope where they are affected as ratepayers Gas Companies too, may be depended upon to see that the insertion of these clauses will provoke a little discussion in the Parliamentary Committee rooms. Altogether for London, in power and bulk and intercommunication schemes, and so on, there is the unlucky number of thirteen; while the Provinces, all told, only claim seven. Of combined lighting and traction Bills there are six. There are Bills including electricity powers to the number of eight, four of which are the introductions of Gas Companies; and several Gas Companies are asking for authority to apply for Electric Lighting Provisional Orders. In four Bills, there are clauses respecting free-wiring and fittings, &c. With regard to Provisional Orders, there are 55 applications. In 1904, there were 74, and in 1905, 62; so that in the three years there has been a gradual decline. Of the applicants in 1905, 33 were local authorities, as against 24 this year; and of companies or firms 29, compared with 31 this year. It is remarked that, although past sessions have seen Gas Companies' Acts containing authorization to apply for Electric Lighting Orders, there is not a single application to the Board of Trade entered from a Gas Company for the coming session. For the figures as to Provisional Orders, we are indebted to "The Electrician."

The more experience that one gleans respecting the "Tantalum" lamps and those which have been given the abbreviated title of "Osmi," the more certain becomes the conviction that those lamps, where economy and reliability are not the least of the considerations, will have little chance in the competition with ordinary incandescent gas lighting. Electricians are constantly speaking of the unfairness of comparisons being made between nominally 16-candle incandescent electric lamps and ordinary incandescent gas-burners. We fail to see that there is anything unfair about it when gas with the incandescent mantle—the only form of gas consumption for lighting now advocated—can give (on public lighting conditions and low-priced current) four or five times more light from the one point at about a uniform cost with, and in cases at less cost than, the 16-candle incandescent electric lamp. It is the much greater value offered for the money paid that makes the comparison admissible. However, we are not going to make the comparison on this occasion, but are proposing to show that ordinary incandescent gas-burners are more economical than either the "Tantalum" or the "Osmi" lamps, and by the figures of an electrical official, although a speaker at a meeting of the Electrical Contractors' Association just recently made the random assertion that "osmium lamps could be had which were cheaper than any form of gas lighting." And that was only one of many foolish and false statements that were thickly sprinkled over the proceedings at the meeting in question. The tests upon which the costs are based which we are about to quote were made at Ealing, by the Business Manager of the Electricity Department, and in the streets. The "Tantalum" lamps are dismissed almost in a line. They gave (the report states) an excellent light; but the lamps tested had too short a life to allow them to be used for street lighting. This is practical experience, and not the fairy-like tale of the laboratory. This leaves only the "Osmi" lamps, and the costs. In regard to them, there are only two points for criticism. The first is that nothing appears to have been allowed for capital charges, which would form a not inconsiderable item on any extensive scheme of utilizing these lamps for public purposes. One electrical contemporary has only this week pointed to the high first cost of such lamps and their other disadvantages, which, of course, it is devoutly hoped will soon disappear. Anyway, the capital charges ought to be taken into consideration, as well as the renewals. The sum charged under the latter head is of an amount that bears out the statement as to the "other disadvantages." The second point is that nothing is indicated as having been charged for labour in cleaning and attention; and attention is not a negligible quantity. Therefore the figures are clearly deficient—high as they are for the duty rendered. The current for two 25-candle power "Osmi" lamps, it is said in the report, could be supplied for £3 per annum (at what price per unit?); and the renewals would cost 24s.—making together £4 4s., without taking into calculation the deficiencies referred to above. This is compared in the report with the cost of two 16-candle incandescent electric lamps, which is placed at £5 8s. 8d., *plus* 5s. 4d. for renewals, or a total of £5 14s., so that a saving of £1 10s. per lamp is to be realized by the substitution of the "Osmi" lamp, and an illuminating power 18 candles greater obtained—that is, assuming the maintenance of the nominal power. We do not know the terms for supplying ordinary incandescent gas-lamps in Ealing; but we do know of places where, for about a sovereign and more less than the pair of "Osmi" lamps is to cost for current and renewals alone, the gas supply, maintenance, cleaning, &c., connected with each incandescent gas-lamp is contracted for, and a light afforded considerably in excess of the (25 × 2) 50 candles ascribed to the "Osmi" lamps when new. The £4 4s. is about the annual cost at Newcastle-on-Tyne for self-intensifying gas-lamps of 300-candle power each. Moreover at Ealing, some shadowless lanterns are to be bought for the experimental lamps, which is yet another expense; but that we should not criticize if a real and economical improvement was going to ensue.

In the long series of articles appearing in the "Standard," in which a crucial examination is being made of the problem as to how and why the rates go up, there has not been a point that has given us greater satisfaction than one which the commentator has raised to special prominence in dealing with the Lambeth borough accounts. The Borough Council are not suffering the remorse of many of their Metropolitan contemporaries who have found electricity a bad investment, and are getting deeper and deeper into the mire the more they try, by subterfuge, to hide the truth of their failure to make a sound financial success of their concerns under the conditions upon which municipal undertakings must necessarily be financed. The result of Lambeth not having fallen a victim to the seductions of electric lighting is shown in this fact: Whereas in all boroughs in which electric lighting has been adopted, there has been, between the years 1888-9 and 1902-3, an increase of many thousands in the cost of public lighting, in Lambeth there has actually been a decrease, amounting to nearly £600. In 1888-9, the cost was £13,707; and in 1902-3, £13,143. This has happened notwithstanding the increase in the population. The "Standard" congratulates the ratepayers upon this reduction in the cost of the public lighting, and commends the Council for the action they took in respect of the Electric Lighting

Order of which the old Vestry had possessed themselves. The Order was transferred to the South London Electric Supply Corporation; one of the conditions being that they were to supply free of cost to the ratepayers 25 arc lamps. What the South Metropolitan Gas Company did years ago in the matter of making the financial path easy for a change from flat-flame lighting to incandescent gas lighting is also a matter for which the ratepayers should now be exceedingly thankful, as they inspect week after week the remarkable flights in public lighting expenditure that have been made by other boroughs.

There was a little very plain speaking at the Colchester Town Council meeting last week on the deficiencies of the Electric Lighting Department. Before dealing with it, however, it appears that the country is a great supporter of the municipal electric lighting concern at Colchester, though the country, if its official representatives looked properly after its interests, could obtain electricity much more economically by the aid of a gas-engine and a generating plant of its own. The War Department represent the country in this matter, and patronize the municipal undertaking to the extent of about 200,000 units per annum, for which the patriotic Corporation have been charging 4d. per unit, while their own Tramways Department have been getting electricity at 1½d. per unit. Without taking into consideration sinking fund and interest, we see that the total costs per unit in the year ending March last came out at 1·7d.; so that the Tramways Department have been unduly favoured, while the War Department have been very hardly dealt with. Between the 1·7d. and the 4d. per unit, there is the considerable, on a unit of such low degree, difference of 2·3d.; and for custom such as that of the War Department, a difference of this kind denotes great cupidity on the part of the municipal authorities. The War Department, in the interests of an over-taxed country, asked for a reduction; and the Council have come down to 3½d. Whether this will give satisfaction, we do not know; but if it does not, the alternative of a gas-engine and generating plant giving electricity at less than 1½d. per unit may be recommended. From this and other evidence, it appears that the Electricity Department are not looking after their affairs in a proper manner. It ought not to have been possible for the Deputy Mayor to have been justified in crying "stinking fish" in the Council Chamber the other night. But he did so. He did not forget, too, to lay some amount of emphasis on what he had to say; and no one ventured to contradict. The irregularity and low voltage of the current was the Deputy-Mayor's gravamen. On two occasions he has telephoned to the electricity works, putting the pertinent question as to why his household should be compelled to use candles in order to read or do anything else. Explanation as to why his family should have to do so, does not appear to have been forthcoming; and the invitation that the Electrical Engineer should pay the Deputy-Mayor a friendly visit during the evening, and test the voltage at the house, has never been accepted. This strikes one, on the *ex parte* statement before us, as being rather rude. But the Electrical Engineer knows his business, and has made the offer to meet Mr. Deputy-Mayor in the middle of the day to make the test! The Engineer of Colchester has his wits about him. The complaining Deputy-Mayor went on to criticize the street lighting, which he describes as defective, and to call the Committee to account for the enormous nuisance caused by the belching of volumes of black smoke from the electricity works' chimney. The Colchester Corporation are not alone among electricity suppliers in being offenders in this respect, though it is their duty to set in motion the Act which provides for the punishment of owners of chimney-shafts which create such nuisance.

PERSONAL.

Mr. JOHN M'GILCHRIST has been appointed Manager of the Gourock Corporation Gas-Works, in succession to Mr. J. M'Ewen, who died recently. Mr. M'Gilchrist has been in charge of the works since Mr. M'Ewen's death. He is the son of Mr. James M'Gilchrist, whom he assisted in the erection of the gas-works at Newport and North Berwick, and in other capacities, in which he has gained a wide experience in gas-works construction.

M. PAUL GIGOT, Chief Works Engineer of the Paris Gas Company, having resolved to retire, after nearly half-a-century's connection with the undertaking, the *personnel* of the Company decided to present him with a *souvenir* in the shape of a work of art. They adopted the rather unusual course of placing it in his office on the 5th ult.; when M. Brissac, on behalf of the donors, asked him to accept it with the best wishes of his "gas family" for himself and those belonging to him. M. Gigot was also entertained at a dinner two days later.

It is understood that Mr. G. W. ANDERSON, the Engineer and Manager of the Primitiva Gas Company of Buenos Ayres, will be resigning his position on the expiration of his agreement, which event we believe takes place in October next. Report also names Mr. Anderson's assistant, Mr. B. F. BROWNE (son of Mr. A. F. Browne, of Vauxhall), as his successor. It will be, next October, five years since Mr. Anderson took up his present position; his appointment having been announced in the "JOURNAL" for Aug. 27, 1901. Previous to going to Buenos Ayres, he was Manager and Secretary to the Caterham Gas Company (now amalgamated with the Croydon Company), and that position he had occupied since 1892.

GAS BILLS FOR 1906.

CONTINUING our review of the Bills introduced for promotion in the ensuing session of Parliament, we deal to-day with the measures of statutory gas companies for further powers.

The Act of the Ascot District Gas Company of 1882 authorized capital to the amount of £60,000, and £15,000 by borrowing; and nearly the whole of these amounts have been raised and expended. The Company now require additional powers, including those necessary for electricity supply purposes. The gas limits, it is desired, shall be extended by the inclusion of Chobham. The quality of gas that the Company now propose to supply is of 14-candle power. A considerable number of the clauses of the Bill are such as are commonly found in measures modernizing the powers of gas companies. Regarding the supply of electricity, the area is that defined for gas supply. For the generating-station, it is intended to appropriate part of the gas-works site; and the Company are asking for powers to purchase an additional 5 acres. The rate per quarter which the promoters ask to be allowed to charge is for any amount up to 20 units 13s. 4d., and 8d. per unit beyond that quantity. When the profits allow of a dividend of 7 per cent. and the payment to the renewal fund, the Directors are to reduce the charge for the supply of energy to such an amount as will, in their judgment, diminish the surplus to the maximum rate of profit. The Company ask for power to refuse a supply to premises having a separate supply, excepting on payment of an annual sum to give a reasonable return on the capital expenditure and other standing charges incurred by the Company. The Company are to supply within a specified area within three years. Following the conferring of these powers, the Company desire that their title shall be extended to the Ascot District Gas and Electricity Company. Additional capital to the amount of £30,000 is required; and as to borrowing powers, the Company request that they may be extended to one-third of their total issued and paid-up capital, which will give a further £5000 on the original capital. On the additional capital issued as ordinary, the dividend is limited to 7 per cent., and on the preference to 6 per cent. Power is sought to declare an interim dividend without calling a meeting of the shareholders for the purpose. A renewal fund is provided for. Separate accounts are to be kept for the gas and electricity undertakings. As to discounts on gas and electricity accounts, the Company put 10 per cent. as the limit for prompt payment, and the maximum rebates to large consumers at 20 per cent. [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

The Brixham Gas Company were in Parliament as recently as 1904; and their progress demands their reappearance in the coming session. The authorized capital under their 1904 Act was £20,000, of which £6000 was original, and £14,000 additional, with corresponding borrowing powers. Nearly the whole has been raised and expended. The Company now ask that their limits may be extended so as to include Churston Ferrers; and that the unexercised powers of the Paignton Gas Company's Act of 1894 in that parish may be repealed. Additional lands for manufacturing purposes are scheduled; and any parts of these lands may be appropriated for the erection of a generating-station for the supply of electricity within the area. By agreement, power is sought to purchase an additional 5 acres of land. A supply of electricity is to be given within a scheduled area within three years. The maximum rates of charge per quarter are to be up to 20 units 11s. 8d., and above 7d. per unit, with discounts of 5 per cent. for prompt payment, and up to 20 per cent. for large consumption. The general powers applying to electricity are similar to those in the Ascot Bill. The additional capital asked for is £20,000, with one-third borrowing powers. The authorization as to dividends under the 1904 Act is to apply in this case. Provision for a renewal fund is also made. In this Bill, in providing for reductions of price, the aggregate receipts of the gas and electricity undertakings are to be brought into calculation, as arranged by the following clause:—

Whenever in any year, it is shown, by the separate accounts by this Act directed to be kept, that the aggregate receipts on the revenue accounts of the gas undertaking and the electricity undertaking exceed the aggregate of the expenditure on the like accounts (including any payment to the renewal fund by this Act authorized to be established) by an amount exceeding the divisible percentage as hereinafter defined, the Company shall make such a rateable reduction in the charges for electrical energy as in their judgment (taking into account any reduction which they may at the same time make in the price of gas) will reduce the surplus to the divisible percentage. "The divisible percentage" means a sum equal to a percentage on the aggregate capital moneys expended on the undertaking calculated at the rate at which the Company are for the time being allowed to pay dividends on their additional ordinary capital issued under the Act of 1904 and this Act, in accordance with the provisions of section 55 of the Act of 1904.

It is proposed that the District Council shall be given the right to purchase the undertaking if they serve a notice on the Company within six months after the expiration of a period of 21 years from the passing of the Act requiring them to sell. General conditions upon which the purchase is to proceed are incorporated, including compensation to the Company's officers who are not retained in the employment of the Council. In this regard it is also provided "that no officer or servant who has been in the employment of the Company for 20 years or upwards shall lose his right to compensation as aforesaid by reason of his declining to enter the

service of the Council." [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

From the preamble of the Bill of the Cardiff Gas Company, it is gathered that, with premiums amounting to £21,970, the ordinary and preference capital created under their Act of 1887, amount to the £250,000 authorized to be raised by that Act; and, under the same Act, £51,000 of debenture stock has been issued. The total of the ordinary and preference stock now issued by the Company is £433,030. It is proposed that the whole of the ordinary stock shall be converted into an equivalent amount of stock with a maximum dividend of 5 per cent. per annum. This is to be apportioned among the existing holders on this scale: £200 of consolidated stock for every £100 of existing ordinary stock entitled to a maximum dividend of 10 per cent., £160 of consolidated stock for every £100 of stock entitled to a maximum dividend of 8 per cent., and £140 of consolidated stock for every £100 of stock entitled to a dividend of 7 per cent., and £100 for every £100 at present entitled to a maximum dividend of 5 per cent. The Company ask for additional capital not exceeding £400,000, with one-third borrowing powers. Authorization is desired to make first offers of new issues to consumers or employees. The Directors seek to be empowered to pay an interim dividend without calling a meeting of shareholders. Section 21 of the Act of 1887 relating to the reserve fund is repealed, and the sum now proposed to be prescribed for the purposes of section 31 of the Gas-Works Clauses Act, 1847, is £75,000. A renewal fund on the ordinary terms is provided for. The Company ask that their limits of supply may be extended; and as part of this extended area is within the district of the Taffs Well Gas and Water Company, Limited, power is sought to purchase this undertaking under an agreement, dated Nov. 6 last, in which the purchase price is stated to be £5000. Additional land powers are also sought; but the authority of the Company for compulsory purchase is to cease after three years. It is proposed to repeal section 35 of the Act of 1887; and to now prescribe the illuminating power of the gas at 14 candles. Regarding the testing of the gas, the table photometer and Harcourt's 10-candle pentane lamp as the standard light are to be used; and the type of burner to be employed in making the tests is to be Sugg's argand, constructed to develop the full illuminating power of the 14-candle gas. On the application of the Company, however, the Board of Trade may approve of any other burner in substitution. The Directors also take power to determine the remuneration of the Secretary. [*Parliamentary Agents: Messrs. Sharpe, Parker, Pritchards, Barham, and Lawford.*]

The Cheltenham Gas Company are asking that their area of supply may be extended, so as to include Southam (otherwise Southam and Brockhampton), Woodmancote, and Bishop's Cleeve, which parishes or hamlets are not now supplied with gas. The Company are also asking for a reduction of the illuminating power of their gas from 15 to 14 candles, to take effect from Jan. 1, 1907, on an average of three consecutive tests taken in any one day. The testing-burner to be used is the "Metropolitan" argand No. 2, or such other burner or chimney (if any) as may be prescribed under the City of London Gas Act, 1868, for testing the illuminating power of gas of the quality of 14 candles supplied by any of the London Companies; the gas being consumed at the rate of 5 cubic feet per hour in such a manner as to obtain from it the greatest amount of light. The standard lamp is to be Harcourt's 10-candle pentane; and the photometer as prescribed by section 30 of the Company's Act of 1872. Within twelve months after Jan. 1, 1907, the Company are, if and when required by any consumer of gas, to supply and fix, free of charge, flat-flame burners suitable for the consumption of gas of the prescribed illuminating power in place of any flat-flame burners then in use. Section 35 of the Company's Act of 1896 directs, *inter alia*, that the gas supplied by the Company shall not contain more than 25 grains of sulphur compounds per 100 cubic feet of gas. It is now proposed by the Bill that section 33 of the Act of 1872 should be repealed, except so much as relates to ammonia, and also section 35 of the 1896 Act, except so much thereof as relates to illuminating power. The Company also ask for authorization to the Directors to declare interim dividends without calling meetings of the shareholders. [*Parliamentary Agents: Messrs. Dyson and Co.*]

Quite adjacent to the present limits of supply of the Derby Gas Company are the parishes of Borrowash, Ockbrook, Etwall, Eggington, Bearwardcote, Burnaston, and Sutton; and some of them are not at present adequately supplied with gas. In the Bill which the Derby Company are now promoting, they seek to have their limits extended, so as to include these parishes; and in this connection they are proposing to purchase, in accordance with a scheduled agreement (which is sought to be confirmed) two limited Gas Companies—the Spondon, &c., and the Mickleover and Etwall. According to the agreement, the considerations to be met by the Derby Company are the discharge of all the debts, liabilities, &c., as existing on July 1, 1905; the payment of a dividend to December last to the shareholders of the respective Companies at the same rate as to the shareholders of the Derby Company, and at the same rate thereafter until the share certificates have been exchanged; and the division of £18,100 of consolidated stock of the Derby Company between the members of the respective Companies according to their respective rights. For the purpose of determining the *ad valorem* duty payable in respect of the freehold property comprised in the respective sales, the consideration for the freehold property belonging to the Spondon Company is to be taken to be £5805, and the consideration for the freehold property of the Mickleover Company as £5558. The purchases are to be completed within 28 days after the Royal Assent has been given to the Bill. Leaving the agreements, and returning to the Bill, it is seen that the Derby Company are to give in exchange for each share held by a member of the Spondon Company £10 of consolidated ordinary stock, and in exchange for every ten shares of the Mickleover Company a sum of £90 of consolidated ordinary stock. Provision is also made for the paying off by the Liquidators (Messrs. J. Ferguson Bell and David Sibbald) of any dissentient shareholders in the two Companies. A clause appears absolving the Company from liability to forfeiture for sulphur impurities other than sulphuretted hydrogen; and another clause is to amend the section of their Act of 1852 relating to the supply of gas and the price for the public lamps by inserting the words "for lighting purposes" after consumer. The Directors are also to be empowered to determine the salary of the Secretary. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The main object of the Epsom and Ewell Gas Company in promoting a Bill is an enlargement and consolidation of capital; but the opportunity is to be taken to bring the powers in certain other directions into line with modern gas legislation. The Company's Act of 1877 enacted that the share capital should be £60,000, whereof £30,000 was to be original capital, and £30,000 additional. The original capital was divided into 1200 shares of £25 each, entitled to a dividend at the rate of 8 per cent. per annum; and the additional capital into 3000 shares of £10 each, entitled to a dividend at the rate of 7 per cent. per annum. The borrowing powers on both the original and additional capital amounted to one-fourth. From Jan. 1 next, it is proposed that the original and additional 1877 capital shall be consolidated and converted into one class of stock, bearing a uniform dividend of 5 per cent. per annum—the £30,000 of original capital being converted into £48,000 of consolidated stock, and the £30,000 additional capital into £42,000 of consolidated stock. The stock will be distributed among present holders in the proportion of £40 for each existing original share, and £14 for each existing additional share. The additional capital asked for is £70,000, with one-third borrowing powers. The standard price proposed for gas is 4s. 6d.; penny variations carrying 1s. 3d. increases or reductions of dividend, as the case may be. The Company contemplate reducing the illuminating power of their gas to 13 candles; and, in testing, it is to be directed that the table photometer, Vernon Harcourt's 10-candle pentane lamp, and Sugg's argand burner for 13-candle gas (known as the "Wandsworth" test-burner) shall be used, or such burner as shall, upon the application of the Company, be approved by the Board of Trade. It is also proposed to be enacted that, if at any time, after the expiration of three years from the commencement of the Act, the Redhill Gas Company are not supplying, or prepared on demand to supply, gas in any part of Walton-on-the Hill, all powers, rights, duties, and obligations of the Redhill Company in relation to the supply of gas within the parish shall cease and determine, and upon such cesser, the Company may lay down mains and supply gas within the parish. With regard to further lands, the Company desire power to purchase up to 10 acres. Provision is also made for reserve and insurance funds. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

The Gas Companies' (Removal of Sulphur Restrictions) Bill was given practically *in extenso* in the "JOURNAL" for Dec. 5, p. 673. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

The Kidderminster Gaslight and Coke Company's Bill is practically a money measure. The capital is now £17,940 of ordinary stock and shares, consisting of £12,000 original and £5940 converted loan capital, with a maximum dividend of 10 per cent. per annum, and £14,400 ordinary shares, with a maximum dividend of 7 per cent.—making in all £32,340 of ordinary stock and shares. The Company have also issued £3600 of preference shares, with a perpetual fixed dividend of 5 per cent. The amount borrowed on mortgage is only £60. The Company, in the first place, desire that their title shall be abbreviated by the omission of "Light and Coke." In connection with the proposed new works, they desire to be empowered to erect (by agreement with the Staffordshire and Worcestershire Canal Company, or their successors, but not otherwise) wharves, piers, embankments, and approaches on land belonging to the Company abutting on the canal. Certain restrictions are placed on the Company in respect of the taking of houses of the labouring classes. The £32,340 ordinary stock or shares it is intended to convert and consolidate into £56,040 consolidated ordinary stock, bearing a uniform dividend at the rate of 5 per cent. The distribution among existing holders is to be for every £100 of 10 per cent. stock or shares £200 consolidated stock; for every £100 of ordinary shares entitled to a dividend of 7 per cent., £140 of consolidated ordinary stock. The Company desire power to raise £57,000 of additional capital, with one-third borrowing powers. Before submitting the new capital to public auction or tender, the stock may, with the approval of the Board of Trade, be offered to the gas consumers and employees. Renewal and insurance funds are provided for. Discounts for prompt payment not exceeding 10 per cent., and on large consumptions 15 per cent., are specified. The prescribed illuminating power of the gas is proposed to be 14 candles, tested by Sugg's 14-candle ("Wandsworth") argand,

or "such other burner as may from time to time be prescribed for testing the illuminating power of gas supplied in the Metropolis for which the prescribed number of candles is fourteen." The table photometer and Harcourt's 10-candle pentane lamp are to be employed in the tests, which are to be made at intervals of not less than half-an-hour each. The prepayment clause allows the excess of 10d. for meter and fittings, 1s. with cooker, and 6d. for meter alone. [*Parliamentary Agents: Messrs. North and Talbot.*]

By the Merthyr Tydfil Gas Company's Act of 1868, the original capital consisted of £11,550, in 330 shares of £35 each, entitled to a dividend of 10 per cent. The Company were then authorized to raise as additional capital £18,450, entitled to a dividend at the rate of 7 per cent., and to create and issue preference stock to the amount of £3300, entitled to a fixed perpetual interest of 5 per cent. In respect of the original capital, the Company were allowed to borrow £2350, and in respect of the 1868 additional capital £4611. The Company have now to meet the expansion of business by constructing additional works; and they ask for the necessary land powers. In this connection, they desire that their contractors, workmen, and servants may be authorized to work over and use the railway viaduct and siding over the River Taff, in the parish of Merthyr Tydfil; and powers are likewise sought for the construction of railway sidings. In addition to the scheduled land, the Company wish to purchase, by agreement, not exceeding in the whole 5 acres. The conversion and consolidation of the capital to a uniform 5 per cent. level is sought—the £11,550 of original capital, with a dividend of 10 per cent. per annum, being converted into £23,100 consolidated ordinary stock, and the £18,450 of additional capital, with a dividend of 7 per cent., into £25,830 consolidated stock. It is proposed that the additional capital shall be £60,000, carrying one-third borrowing power. Insurance, renewal, and reserve funds are arranged for. With a standard price of 3s., the sliding-scale is applied on the basis of 1s. 3d. changes in dividend on variations of 1d. in price in respect of any half year. The manner of testing gas, under the conditions imposed by the Company's 1868 Act, is to be altered—the table photometer and the Harcourt 10-candle pentane lamp being employed, with a burner of the argand type "constructed to develop, and shall be so used as to develop, the full illuminating power of the gas." [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

The Mirfield Gas Company have exhausted their capital powers; and they now ask that the shares may be converted and consolidated into one class of stock, on the following scale: £10 ordinary stock for every original share of £5, and £14 ordinary stock for every new share of £10. Additional capital powers not exceeding £90,000 are sought. Inclusive of the £10,000 already borrowed in pursuance of the Act of 1879, the promoters desire permission to borrow up to one-third of the nominal amount of the ordinary stock into which the existing original £5 shares and the existing "new" £10 shares are converted and consolidated; and one-third on the additional capital now proposed to be authorized. Necessarily, on the conversion of the capital, the sliding-scale provisions in the 1879 Act are to be amended by the substitution of 2s. 6d. for 5s. as the increment or decrement of the dividend on changes in price. The Directors are asking to be invested with specific power to appoint, suspend, or dismiss all officers and servants, and to determine their salaries or other emoluments. The Company propose an illuminating power for their gas of 15 candles. Discounts of 10 and 15 per cent. for prompt payment and large consumption are specified; but the Company are also seeking for authority to contract for the supply of gas for power purposes, for a period of at least twelve months—the supply in that period to be of not less than a million cubic feet. But "the Company shall not be bound to supply gas to be used for power purposes to engines attached to private power or suction-gas plants under any such contract . . . unless, and for such period only as, such supply can be given without interfering with the supply of gas for public or private lighting purposes, or for use for power purposes by consumers whose engines have no connection with any such private power or suction-gas plant." Separate service-pipes for such supply are also stipulated. For prepayment supply, the excess is proposed at 1s. for "meter and fittings," and 10 per cent. on cost for meter alone. [*Parliamentary Agents: Messrs. Robbins, Billing, and Co.*]

(*To be continued.*)

Monazite.

In his report for 1904, Sir F. Lugard, the High Commissioner for Northern Nigeria, states that the examination of the sands of certain rivers has revealed the fact that small quantities of monazite occur. These deposits will be thoroughly investigated.

In the "JOURNAL" for Dec. 19 (p. 833), was published a list of awards in connection with the recent exhibition of smoke abatement appliances, and since then it has been noted that a bronze medal was also awarded to Messrs. Fletcher, Russell, and Co., Limited, for a rapid water heater with safety tap. From the completed list of awards, it is seen that Messrs. W. Sugg and Co., Limited, also had bronze medals conferred on them for billiard table lights and for high-pressure incandescent street gas lighting. Messrs. Wilsons and Mathiesons, Limited, were also successful with an air-extracting gas-fire.

THE PROGRESS OF GAS LIGHTING IN PARIS.

IN view of the termination of the concession of the Paris Gas Company on the 31st ult., and the decision come to by the Municipal Council on that day to carry on the supply of gas under a provisional arrangement with the Liquidators of the Company, pending the acquisition of the whole of the works and plant at the end of the current year (as recorded in the "JOURNAL" last week), it may not be uninteresting to sketch the progress of gas lighting in the French capital since its introduction. This we are enabled to do from the valuable work which was brought out by M. Henri Maréchal, one of the Municipal Engineers of Paris, about eleven years ago, and noticed in our columns at the time, entitled "L'Eclairage à Paris."

It is unnecessary to follow M. Maréchal through his instructive historical survey of the lighting of Paris down to the days of Philippe Lebon, who is claimed by some to have been the discoverer of gas. It is pretty generally known that towards the close of the Eighteenth Century he conceived the idea of treating sawdust in a closed vessel, and passing the products of combustion through water, which removed their bituminous ammoniacal properties, and left a pure gas that gave a brilliant light on ignition. On Sept. 28, 1799, Lebon took out his first patent for "a new method of employing combustibles more usefully for heating and lighting, and obtaining various products therefrom." Two years later, he constructed what he called "thermo-lamps or stoves capable of heating and lighting with economy, and also of furnishing, in addition to several valuable bye-products, motive power applicable to all kinds of machines." Unfortunately, he was unable to follow up his discovery and make it successful, as he died in Paris—it is believed at the hand of an assassin—in 1804. His widow, however, continued to make experiments with the "thermo-lamp;" and she was granted a pension of 1200 frs. by Napoleon till her death in 1813. About this time, Winsor, who had seen gas lighting introduced in London, went over to Paris (communication with the city having been established as the result of the events of 1814), and endeavoured to get it adopted there. But strong objections were raised to the odour and to the toxic and explosive properties of his gas. He nevertheless persisted in the advocacy of the new illuminant; and he eventually succeeded in forming a company who, in 1817, lighted the Passage des Panoramas. The Company, however, went into liquidation, as did another one promoted by M. Pauwels, an engineer.

These attempts to effect an improvement in the lighting of the city, unsuccessful though they were, evidently made an impression on some of the more far-seeing of the inhabitants; for in 1818, the Comte de Chabrol—an old Polytechnic scholar and a strong partisan of gas—who at the time was Prefect of the Seine, put up some small works on a piece of land adjoining the Hôpital St. Louis, lighted the building from them, and thus demonstrated the superiority of the new system over that previously in use. The result of his enterprise was that he obtained permission to construct other works on a larger scale, at the King's expense, for lighting the Luxembourg Palace; and this was successfully done in 1820. From the same works a supply of gas was taken for lighting the Odéon Theatre. It will thus be seen that this powerful official figured conspicuously in connection with the gas supply of Paris in its earliest days, as he is doing now; the Municipal Council having called upon him to present to them, as early as practicable, a scheme for the future control of the great gas undertaking they are about to acquire.

These installations of the new light made, as we have said, considerable impression upon the public; and, notwithstanding the efforts of certain eminent writers to decry gas, by declaring that it destroyed trees, asphyxiated human beings, overturned vehicles in the streets, and blew out the fronts of houses, it gradually grew in favour. Demonstration of its capabilities as an illuminant was sufficient; and companies began to be formed to take it up. The first—the Compagnie Française—was founded in 1820 by MM. Larrieu, Brunton, Pilté, et Cie., whose works were situated in the Faubourg Poissonnière. This was followed by five others: An English Company; promoted in 1821 by Messrs. Manby, Wilson, and Co.; the Belleville Company, formed by MM. Payn et Cie. in 1834; the Lacarrière Company of the same year; the Paris Company, promoted by MM. Pauwels, Dubochet, et Cie. in 1836; and the Western Company, founded in 1839 by MM. Gosselin et Cie. These six Companies appear to have had the right of supply over the whole of Paris; and the result was very much the same as it was in London in the early days. Conflicts arose; and in order to put a stop to them Paris was "districted" by public decree on Nov. 30, 1839. In 1844, it was decided that the Companies should make an annual payment of 200,000 frs. (£8000) for the privilege of occupying the subsoil with their mains.

At the outset, the conditions under which the several Companies worked were rather precarious—their concessions being revocable; but on Dec. 12, 1846, a Treaty was signed, and was approved the next day by the King, conferring on each Company the exclusive right to lay down and maintain pipes for the conveyance of lighting gas for distribution within the areas defined in 1839. This concession was to remain in force till Dec. 31, 1863. Three of the Companies supplied gas for public lighting at 24·4 c. per cubic metre (5s. 6d. per 1000 cubic feet), and the others at 35 c. (7s. 10½d. per 1000 cubic feet). The price charged to private

consumers was 49 c. in 1847; but it was reduced to 41 c. in 1855—a reduction equal to from 11s. to 9s. 3d. per 1000 cubic feet. In 1855, the Companies decided to amalgamate, and the Paris Gas Company—the "Compagnie Parisienne d'Eclairage et de Chauffage par le Gaz," to give it its full title—was constituted. They were granted a concession for fifty years, from Jan. 1, 1856, conditionally on supplying gas at 15 c. per cubic metre for public lighting, and at 30 c. per cubic metre to private consumers—equal respectively to 3s. 4½d. and 6s. 9d. per 1000 cubic feet. These prices remained in force till the beginning of 1903, when, as the result of much agitation, the charge to private consumers was reduced to 20 c. per cubic metre (4s. 6d. per 1000 cubic feet) on conditions which have been duly recorded in the "JOURNAL."

When the amalgamation took place, the following works were in operation: Vaugirard and Poissonnière (French Company), Ivry (Paris Company), Passy (Western Company), Belleville (Belleville Company), Les Ternes and Trudaine (Sté. Marguerite et Cie., the successors of the English Company), and La Tour (Lacarrière Company). The first thing the new Company did was to overhaul these works, with the result that the Poissonnière, Trudaine, and La Tour stations were shut down, in accordance with the terms of the concession—it being considered that they were too near the centre of the city—and replaced by large works at La Villette, in close proximity to the Northern and Eastern Railways. When Paris was extended in 1860 by the annexation of the suburban communes, the Company purchased the works at Boulogne-sur-Seine, St. Mandé, St. Denis, and the Batignolles. Three years later, new works were built at Maisons-Alfort. At that time, the Company were making 100,833,258 cubic metres (about 3560 million cubic feet) of gas; and since then there has, with a few exceptions, been a steady increase. Consequently, notwithstanding the extensive manufacturing plant at their disposal, the Company felt themselves called upon to erect additional works; and in 1880 the fine station at Clichy was built, and furnished with the most approved appliances. Those of our readers who visited Paris on the occasion of the International Gas Congress at the time of the last Exhibition were afforded an opportunity of inspecting this excellent example of modern gas-works. Some nine years later—in 1889—the first furnaces were fired up at Le Landy, at which station hand labour is reduced to a minimum. By the closing of the works at the Batignolles, Belleville, Les Ternes, and St. Denis, the stations were reduced to nine—viz., Vaugirard, Ivry, Passy, La Villette, Boulogne, St. Mandé, Maisons-Alfort, Clichy, and Le Landy. As evidence of the great development of the Company's business, it may be mentioned that in 1855 the consumption of gas was only 40,774,400 cubic metres, or about 1440 million cubic feet; whereas in the year ending Dec. 31, 1904 (the last for which figures are available), it amounted to 379,740,238 cubic metres, or about 13,410 million cubic feet.

In what has preceded, the Gas Company has been referred to as though it were a perfectly independent business concern. This, however, was not the case. It has already been mentioned that a condition of the Treaty of 1855 was that the price of gas should be 30 c. per cubic metre to private consumers and half this figure for the public lighting. But there were other conditions. The Company agreed to pay the City the 200,000 frs. per annum as rental for the subsoil of the public thoroughfares occupied by their mains, for which their predecessors were liable; also to pay an *octroi* duty of 2 c. per cubic metre of gas consumed, and to divide equally with the Municipality, as from Jan. 1, 1872, all profits exceeding 10 per cent. on a capital of 55,000,000 frs. (£2,200,000). In this way a sort of partnership with the City was set up. The Company also undertook to extend their mains at the request of the Administration, and to enlarge and improve their works so as to make them equal to meeting the requirements of the consumers. At the same time the City reserved to itself the right to have shifted, or even taken up, at the Company's expense, and without compensation, any pipes which required removal in the general interest of the public. In an appendix to the Treaty, it was specified that at the end of the concession the City was to become the proprietor, and to take possession, without paying any indemnity, of all the pipes and accessory distributing plant in use in the public thoroughfares. The same appendix specified the conditions under which the works were to be acquired, and which, curiously enough, had been omitted from the original Treaty. It was agreed that at the end of the concession the City was also to become the proprietor of the works and manufacturing plant for a sum to be determined by experts. The Treaty of 1855 also stipulated that if, owing to the progress of science, the Administration, acting upon the initiative of the Municipal Council, at any time deemed it advisable to call upon the Company to adopt processes foreign to the system of gas manufacture actually in use, the Company were to comply with the requirements. Provision was also made for holding inquiries, at intervals of five years, with the view of ascertaining whether there had been any improvement introduced into the working calculated to effect substantial economy in production; and, if it was found that this had occurred, the Company were to give the public and private lighting the benefit of it in the shape of a reduction in price, in the proportions determined by the Administration, acting under the advice of the Municipal Council. The Treaty likewise contained a clause leaving the City free to introduce "a method of lighting other than that by gas" without being held liable for payment of an indemnity to the Company.

Later Treaties will be noticed in a subsequent article.

CHARRED COAL AND SMOKE ABATEMENT.

By SAMUEL GLOVER, of St. Helens.

In the "Editorial Note" on the article on "Charred Coal" by Mr. W. D. Scott Moncrieff (published last week), discussion of the proposals advanced by this gentleman was invited. I accept the opportunity offered of saying that there are so many points upon which Mr. Scott Moncrieff's ideas and the experience of gas engineers are at issue, that I consider they ought to be stated. In fact, I felt this when I heard expression given to the ideas at the conference which I had the pleasure of attending. But there was then no opportunity of stating them. Many "JOURNAL" readers know that these ideas are not new; and I am afraid that, notwithstanding the repeated emphasis recently given to them, we shall not be able to accept them—even the most energetic and advanced members of our profession will hesitate to do so. I consider the following are some of the points raised by Mr. Scott Moncrieff which gas engineers will agree show the unreasonableness of the conclusions arrived at.

The assertion that the existing plant is amply sufficient to carry out these proposals proves that he knows very little of the circumstances under which the London Gas Companies have to handle the bulk of coal they now use in their operations, to say nothing of the handling of the coke. If he did, he would not propose that they should handle three times the quantity of coal, and only take about one-third the total gas from it.

Mr. Scott Moncrieff appears to offer 3333 cubic feet of about 24-candle gas as an equivalent for 10,000 cubic feet of 16-candle gas per ton of the carefully selected gas coals as likely to be obtained from all the coal which is now delivered into London for domestic purposes, and concludes that such quality of charred coal would be obtained from it all as he may have obtained from gas-making coals without having considered the enormous cost of getting the charred coal out of such retorts as are now worked, and which he has concluded are "amply sufficient."

Nor does he seem to have allowed for the effect upon the heating of the retorts of the new arrangements, which would subject three times the quantity of coal to the heat of the retorts during the period when the heat is absorbed from them most severely. When he has done so, I think he will need to modify his conclusion as to how much of the residual smokeless fuel would be required for the extraction of the gas.

It will be noticed that Mr. Scott Moncrieff carries us backwards a long way when he suggests the distribution throughout London of 24-candle gas, and makes the assertion that the value of gas varies directly as its illuminating power.

The results obtained by the carrying out of these proposals are described as startling. I can quite imagine they would be to those who tried to carry them out in those works which are asserted to be "amply sufficient." But they would be startling in ways not anticipated by those who make the proposals, nor pleasant to those who were responsible for the conducting of the operations.

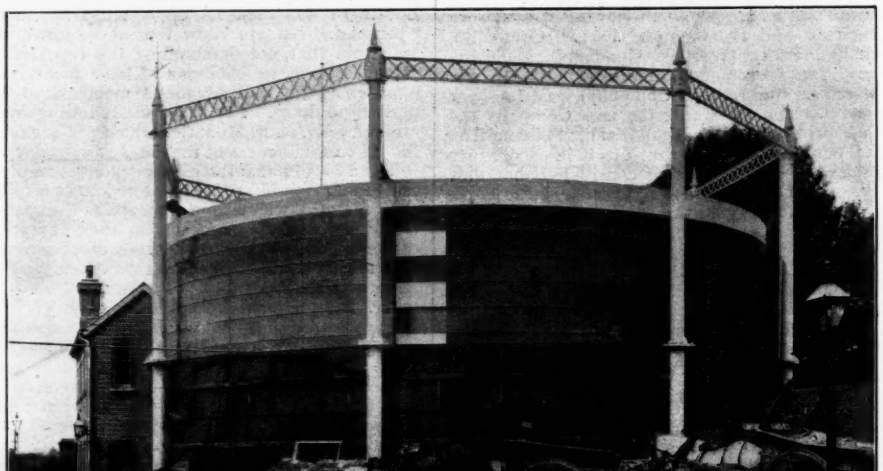
The easy way in which it is concluded that the largely-increased quantities of the bye-products (other than the solid ones) can be calculated to fetch present market prices shows that this point has not been sufficiently considered, as I think it would be found, in these days of coke-oven products, that there would be a slump in prices if the market was flooded with this enormous increase at this particular centre.

I notice that the author of these ideas now claims that the Germans have done something to put his scheme into practice in the way they are working their coke-ovens. But the conditions which obtain in carbonizing coal in coke-ovens are quite different from those which obtain in gas-works' retorts of the present day; and I hold that gas-works as now constructed and worked are quite unsuitable for carrying out the idea of the manufacture and supply of charred coal. The details of the handling of each ton of coal operated are too great. But I anticipate enormous changes and developments in this department of coal-gas engineering in the near future, which will add scope to, and bring about the cheapening of, these operations, and may in some measure assist in carrying into practice some of the ideas of the Royal Sanitary Institute and the Coal Smoke Abatement Society. In the meantime, the members of these Societies might perhaps do a little more to encourage the use of gaseous and solid smokeless fuels which the gas-works of to-day are doing so much to place ready to their hands, and at the doors of the communities which these Societies desire to serve.

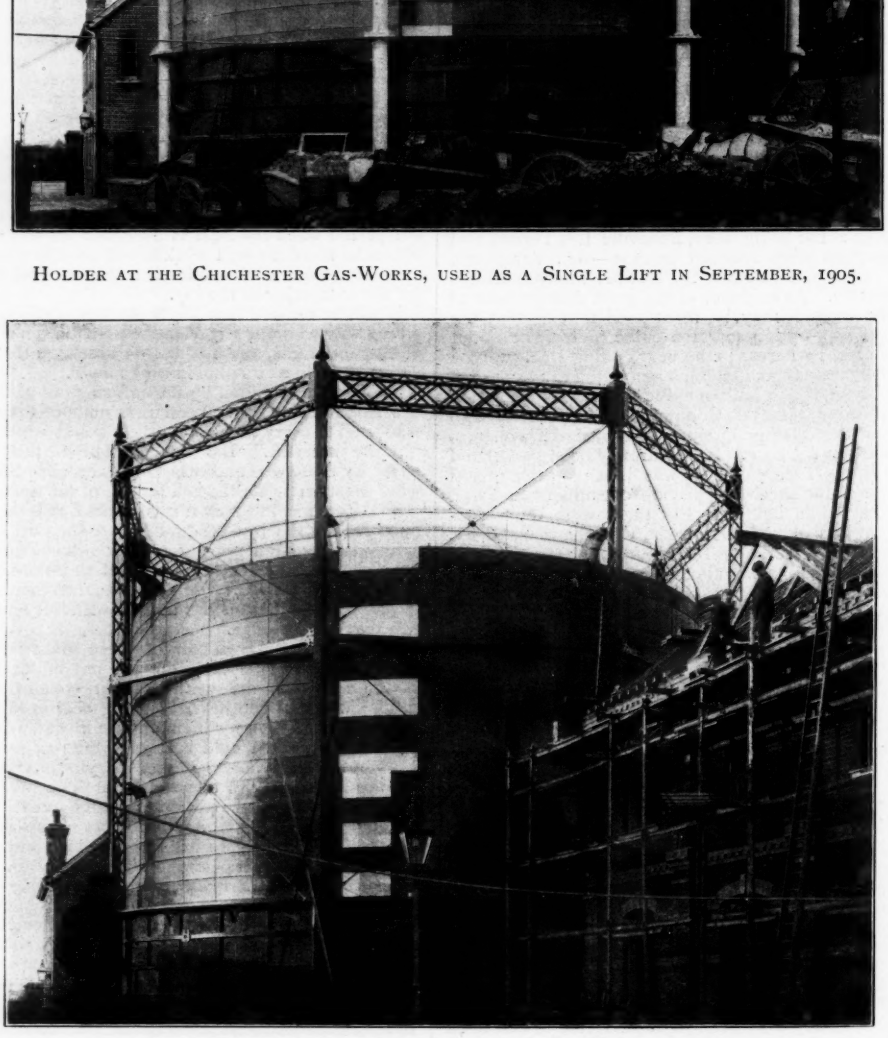
Double Generator Furnace for Long Gas-Retorts.—The Stettiner Chamotte Fabrik Actien Gesellschaft have taken out a French patent for a double generator furnace for long gas-retorts. Each set of retorts is heated by means of a single generator, which is charged from one side of the bench only, and is so constructed that one portion of the generator gas is used for heating the rear halves, and the other for heating the front halves of the retorts. The retort setting is divided by a transverse partition into two compartments, the one containing the rear half of each retort, with appropriate combustion and air flues, and the other the front half, with similar flues. The gases from the rear chamber pass upwards through the rear portion of the setting, while those from the front chamber rise through the front portion.

AN EXAMPLE OF QUICK ENGINEERING.

It is very frequently said that for examples of "smart" work one has to go to the other side of the Atlantic. But we venture to think that a piece of engineering lately carried out by Messrs. S. Cutler and Sons for the Chichester Gas Company, some particulars of which have been supplied to us by the Engineer and Manager (Mr. T. E. Pye), will, in colloquial phraseology, "take a lot of beating." Last August, the Directors decided that the single-lift holder shown in the first of the accompanying photographs should be telescoped, and brought into use again during the late autumn; and the alteration was entrusted to the above-named firm. The holder was working in September as a single-lift, and in October as a double-lift one, as shown in the second photograph; and it has been in continuous use ever since. The completion of the work in so short a time is highly creditable, and amply justifies Mr. Pye's description of it as "lightning engineering."



Holder at the Chichester Gas-Works, used as a Single Lift in September, 1905.



The Same Holder converted to a Double Lift and in Use in October, 1905.

Corrosion of Iron and Zinc.—In a series of short papers contributed to the Chemical Society in 1903, Dr. Moody laid stress on the action of carbonic acid on iron; this metal readily dissolving to form a soluble ferrous bicarbonate, which on exposure to atmospheric oxygen undergoes oxidation to hydrated ferric oxide (rust) and regenerates carbonic acid. The cycle of changes was considered by this investigator to constitute the ordinary process of the aërial corrosion of iron; and he stated that iron, when exposed to water and oxygen, either in the absence of carbonic acid or in the presence of substances which destroy this acid, does not rust to any marked extent. The atmospheric corrosion of zinc was also explained on similar lines; for a sample of this metal when exposed for some months became coated with a scale of basic carbonate (normal carbonate and hydrated oxide), thus manifesting the interaction of the carbonic acid of the atmosphere. In the Engineering Supplement to "The Times," attention is called to the fact that Dunstan, Jowett, and Golding have recently published an account of experiments which go to show that changes of temperature play an important part in causing the rusting of iron.

THE ASTORIA GAS-WORKS OF THE CONSOLIDATED GAS COMPANY OF NEW YORK

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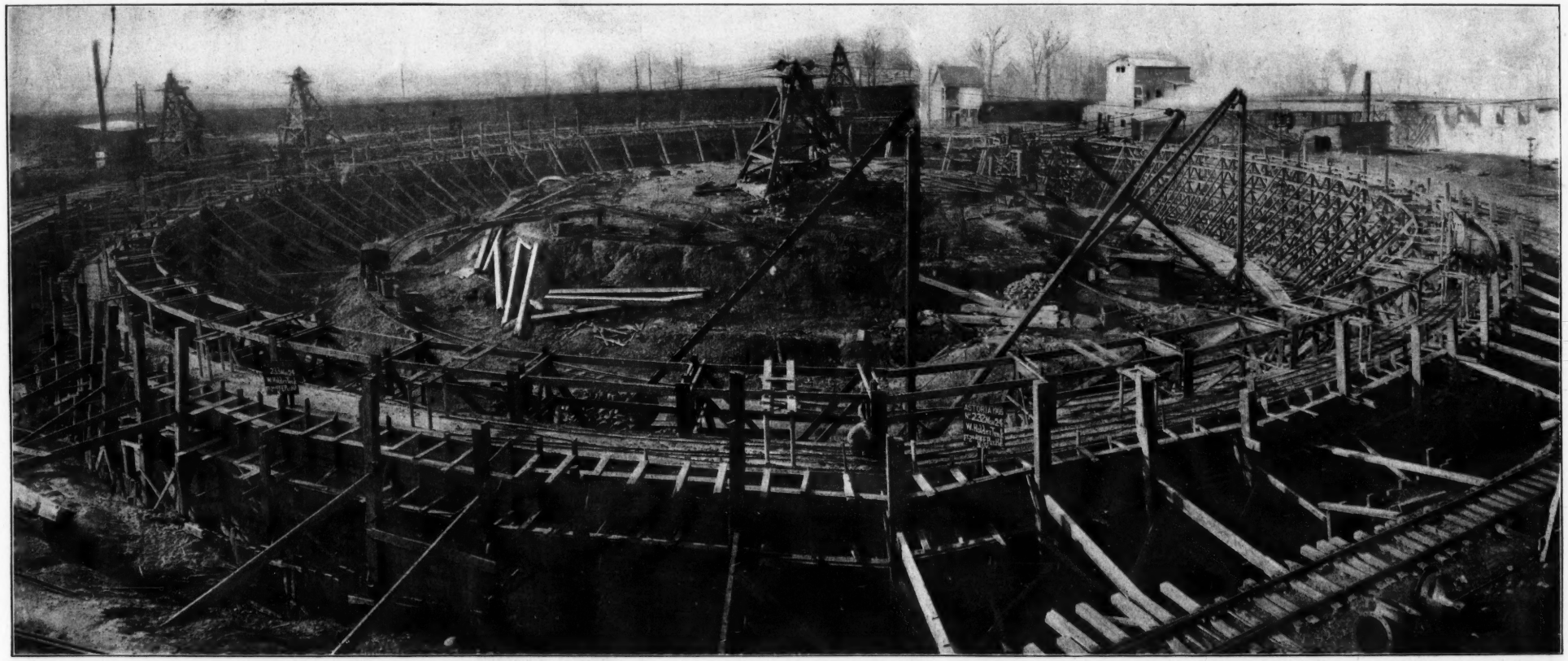
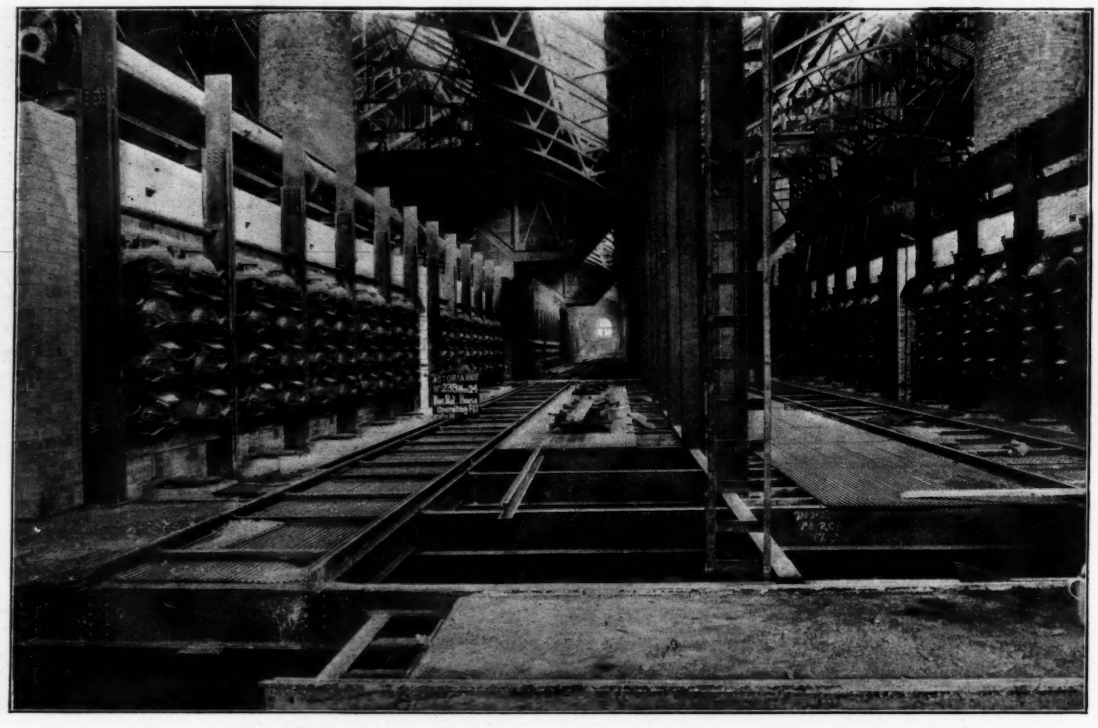


CONSTRUCTING THE FIRST LARGE GASHOLDER TANK AT THE ASTORIA WORKS OF THE NEW YORK CONSOLIDATED GAS COMPANY.

SOME fourteen months have passed since the "JOURNAL" gave a short account, with a number of excellent photographs, of the position at which the constructional work had just previously arrived connected with the magnificent gas-works scheme that Mr. W. H. Bradley, the Chief Engineer of the Consolidated Gas Company of New York, is carrying out for his Company on Long Island. The features of interest in the scheme, it will be remembered, are manifold ; and the whole project is distinguished for its vastness and comprehensiveness. Our last series of illustrations was kindly sent to us by Mr. Bradley through Dr. A. H. Elliott, the Engineer-Chemist of the Company, who was, in the fall of 1904, on a visit to this country. The publication of the series was spread over four issues (Oct. 18 to Nov. 8, 1904) ; and Mr. Bradley has now given further interest to his professional colleagues in this and other countries, and placed them and ourselves under further indebtedness, by enabling us in to-day's issue to publish a further pictorial representation of progress made with the first section.

Only the briefest reference can now be made to the new photographs. The view inside the horizontal retort-house was taken through the centre of the building, and shows the charging-floor. The house contains sixty beds of eight retorts, 21 feet long. The view in the inclined retort-house, which contains 64 settings of nines, 20 feet long, gives a clear idea of some of the interior structural details both of building and settings, from one of the discharging-stages. The underground tar-tanks are shown in course of construction in another photograph. They are built



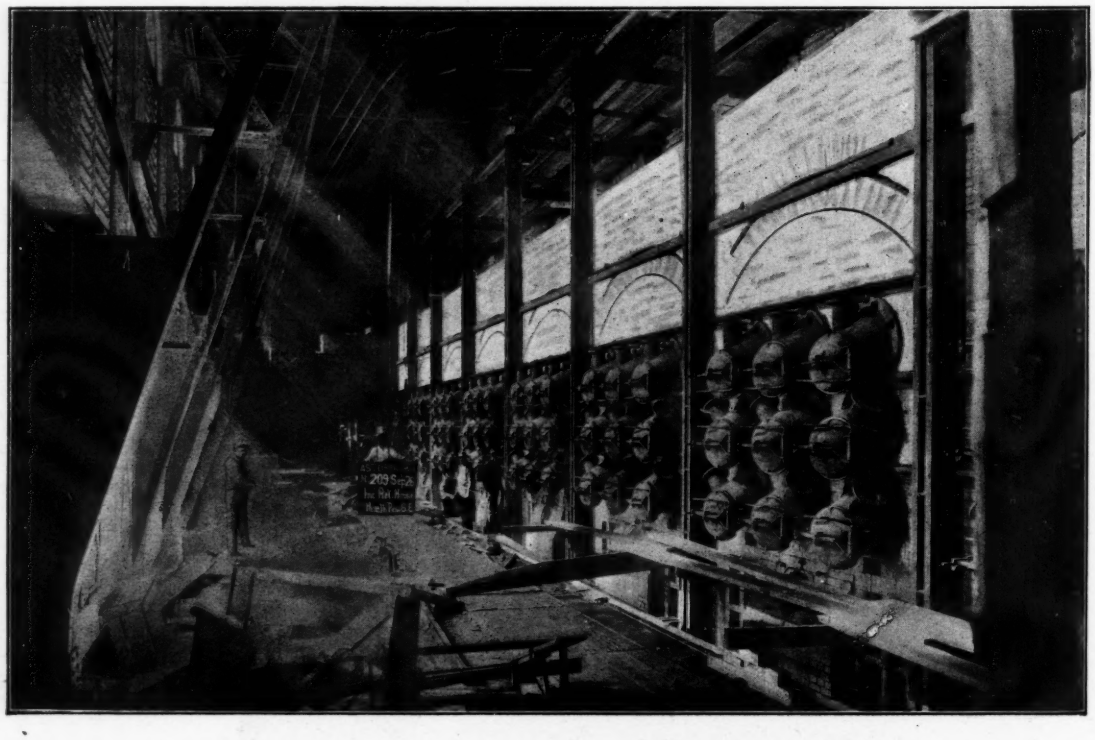
View in the Horizontal Retort-House at the New Astoria Gas-Works for New York.

of limestone concrete, and will be capable of taking four days' production of tar. They are situated between the retort-houses; the view looking north. Among the other small views, there is one presenting the arrangement of valves under the purifier-house, as well as the conveyor-trench, which is also built of concrete. Incidentally, it may be mentioned that practically all the concrete work is made with limestone, and without sand. The large photograph shows the construction proceeding in connection with the tank of the great gasholder. The tank is also being built of limestone concrete, and is 300 feet in diameter, and has a depth of 48 feet. The wall is 9 feet thick at the bottom and 5 feet at the top.

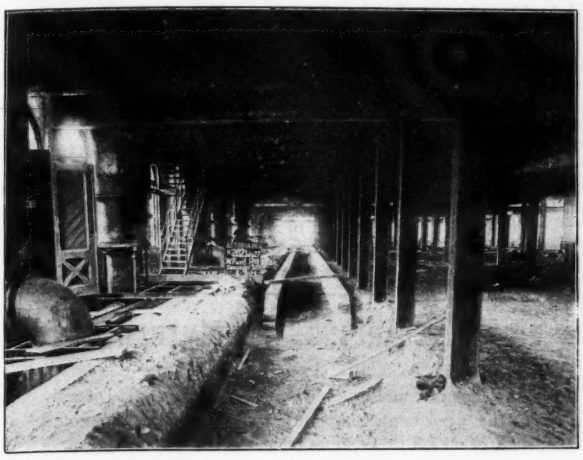
Further particulars as to the portions of the works here illustrated may be obtained by referring back to the short series of articles published in 1904.

The engagement of marriage is announced of Mr. Basil Aird Whittaker, elder son of Mr. Basil Ellis (Messrs. John Aird and Sons), of Oxshott, Surrey, and the elder daughter of Mr. Luke Fildes, R.A.

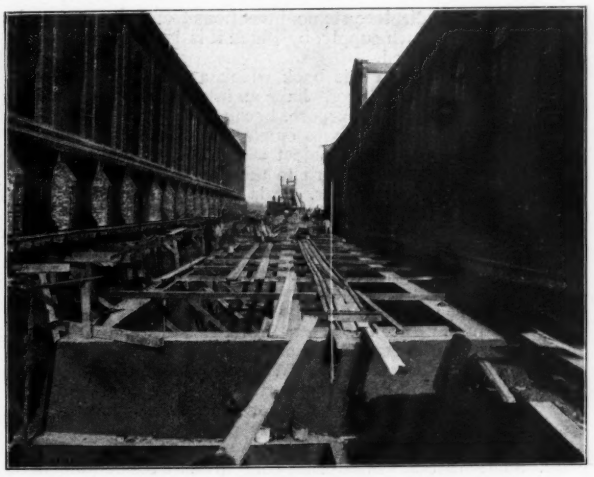
The exhibition which it was proposed to hold in Edinburgh next year has now been postponed until 1908, in consequence of the strong representations made by the Dublin Exhibition Committee as to the injurious effects that would result from the holding of two exhibitions the same year.



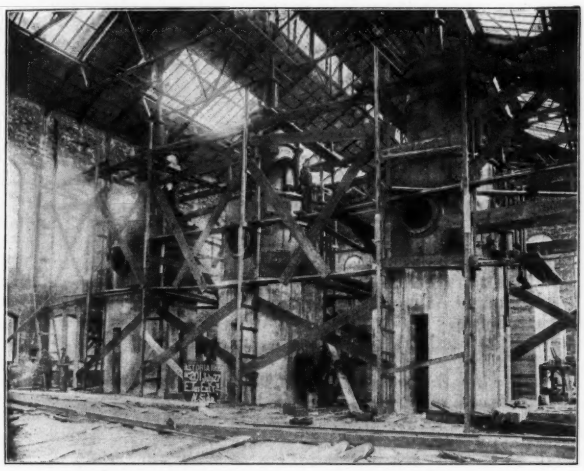
One of the Discharging Floors in the Inclined Retort-House.



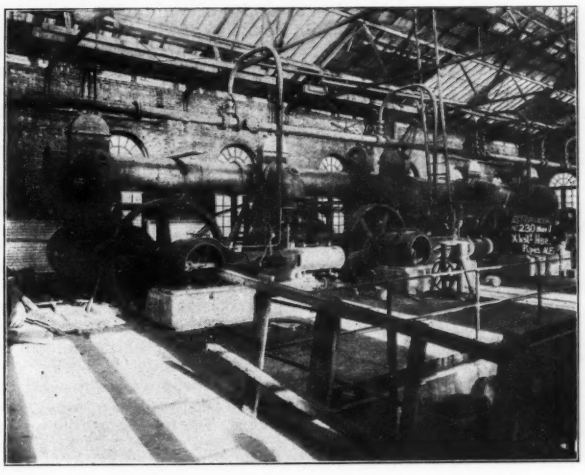
THE BASEMENT OF THE PURIFIER-HOUSE, SHOWING THE ARRANGEMENT OF THE VALVES AND THE CONVEYOR-TRENCH.



THE BUILDING OF THE UNDERGROUND TAR-TANKS ON THE NORTH SIDE OF THE WORKS.



THE TAR EXTRACTORS.



THE EXHAUSTER-HOUSE.

GAS, OIL, AND AIR ENGINES.

A FOURTH edition of that classical work by the late Mr. Bryan Donkin, "Gas, Oil, and Air Engines,"* bears evidence, not only of its popularity, but also of the rapidly increasing importance of the subject to which it relates. The first edition, published in 1893, saw the gas-engine in what may be described as the first stage of its later development, when, at the hands of Otto, it had fully emerged from the experimental stage, and taken its place as a convenient motor, though its chief recommendation was, as stated in the preface, the absence of a boiler. Since that date, not only has the number of internal combustion engines in use for industrial purposes enormously increased, but they have also been greatly improved in efficiency; while the limit as to size has outgrown the most sanguine anticipations. The present edition, which has been brought up to date by the late Mr. Bryan Donkin's Secretary, deals comprehensively with this progress, and also with the latest developments in the production and supply of suitable gas.

It is stated, however, that the great development of gas-engines within the last few years in England is attributable in the first place to "the extensive and increasing application of electricity to lighting, and the demand which has arisen for gas-engines to drive dynamos in country mansions, &c., as being more suitable and economical than steam." This, if it were ever true, has long ceased to be a correct explanation of the position which the gas-engine occupies in the industrial world. For example, it was reported quite recently that in Birmingham alone something like 960 million cubic feet of town gas are consumed annually in gas-engines; and of this quantity it is safe to say that not a tenth part is used for driving dynamos. Nor is it any longer correct to say that coal gas gives more light when furnishing power electrically through a gas-engine and dynamo, than when the same quantity of gas is burnt in the ordinary way. This statement, attributed to Sir William Siemens, was made prior to the advent of incandescent gas-burners, which materially altered the basis of calculation—a circumstance which was deserving of notice in this latest edition. As contributing to the great impetus in the manufacture of gas-engines during recent years, the first place must be given to the expiration of the Otto patent, in 1890, and the consequent reductions of price. Until then, the industry was practically a monopoly, in the hands of a single firm. Now there are about fifty makers of gas-engines in this country alone; and the total output is estimated by Mr. Dugald Clerk at about 100,000 motors, averaging 20-horse power. In 1893, the heat efficiency of the best engines was about 22 per cent.; and the maximum power was from 200 to 300 indicated horse power. At the present time, the heat efficiency of the best engines is 29½ per cent., and the maximum power attained is 4000-horse power. The improvement in heat efficiency is mainly attributable to the employment of increased compression; pressures of 60 to 80 lbs, having given way to pressures of 120 lbs. and upwards per square inch.

Without doubt the purveyors of illuminating gas have benefited greatly from the introduction of gas-engines, by reason of the increased consumption which these have occasioned. It is, however, equally true that the development of internal combustion motors was to a great extent rendered possible only by the existence everywhere of a suitable gas supply obtainable at quite moderate cost. Had such development continued to be dependent upon the obtaining by other means than the employment of illuminating gas, of a suitable explosive gas, it is to be feared that the gas-engine industry would have been but a languishing one, instead of the highly flourishing one it now is, even if the engine itself had passed the experimental stage. All the early inventors of gas-engines—Barber, Street, Lebon, and others—came "an age too soon," for there was not in their time any available gas. It consequently fell to the lot of others, many years afterwards, to work out their ideas. Now, however, that the supply of illuminating gas has resulted in such a development of gas-motors as to bid

* "A Text-Book on Gas, Oil, and Air Engines." By (the late) Bryan Donkin, M.Inst.C.E., &c. Fourth edition, revised and enlarged. London: Charles Griffin and Co., Limited; 1905.

fair to completely displace steam, inventions teem with proposals for substitutes for such supply, by which it is hoped the working cost may be diminished.

The three chapters in this book which are devoted to "Gas Production for Motive Power," have an interest for gas engineers beyond their immediate purpose, because they are a complete record of the various processes employed for the production of heating gas; this being an object which they do well to keep steadily in mind, having regard to the gradually decreasing importance of illuminating power. It is not yet clear whether the gas of the future will be of high or low grade in regard to calorific value. At present there seems to be but little choice, on the ground of economy, between low-grade illuminating gas (which means high grade calorific value) and low-grade calorific value. In the chapters before us almost every conceivable process finds a place; but were one inclined to be captious, it might be objected that undue prominence is given to Mond gas, of which there is a full description—the chief merit of this gas being in the process for the recovery of its ammonia. We miss, also, an illustration of the Duff producer, of which there is only a brief description. This form of producer is used largely for the production of heating gas, both with and without recovery plants; the former giving results corresponding to those which are obtained with the Mond plant. Suction producers naturally come in for a considerable share of attention. English gas makers can hardly have too soon made up their minds to meet the competition of this form of producer by "cutting" the price of gas to power users, seeing that of the Deutz producer alone, it is stated that more than 1500, with an aggregate of 50,000-horse power, have been made since July, 1901. The consumption in this producer is said to be from 1·5 lbs. to 0·9 lb. of coke, and 1·2 lbs. to 0·7 lb. of anthracite per brake-horse power hour. It is made from 6 to 160 brake-horse power, and has been applied successfully to marine purposes. Whatever may be its effect upon the consumption for gas-engine purposes of illuminating gas, there can be but little doubt that this form of producer is contributing largely at the present time to the more extended use of gas-engines. In this country, the plants constructed by Tangyes and Crossley Brothers are among the most prominent. Of the former, there is a very good illustration.

If the gas of the future were to be required for motive power alone, it is undoubtedly to a low quality of heating gas that attention should be directed; since the development of the gas-engine has now rendered the use of such gas not only possible, but in some respects advantageous. The utilization of blast-furnace gases forms an exceedingly interesting, not to say entrancing, chapter of this work. There is, indeed, something fascinating in the possibility of turning to useful account the huge quantities of combustible gases, the burning to waste of which hitherto, has, in all iron-producing districts, turned night into day. It is computed that the available gases from the total production of pig iron in Germany would alone, if all were utilized in gas-engines, and after providing necessary power for the furnaces, amount to 50,000-horse power per day. In England alone, it is reckoned that probably about 2,000,000-horse power might be utilized annually, instead of being wasted; the suggestion being that, by burning their surplus gases in engine cylinders, blast-furnaces could be converted at little cost into central power stations, and a fresh industrial stimulus might be given to a whole district. The idea is certainly worth thinking out, not only in its relation to the employment of gaseous fuel, but also, and chiefly, because it should tend to reduce the cost of production of pig iron. This gas has a calorific value varying from about 90 to about 110 B.T.U.; and the chief difficulties in the way of its utilization are its high temperature and the large quantities of grit and dust which come away from the furnace with it. These are, however, by the efforts of Mr. B. H. Thwaites and others, being overcome; and according to Mr. Humphrey the number of large engines for driving dynamos worked with blast-furnace and power gas was 400 in June, 1903—with a total of 206,800-horse power—nearly 100,000-horse power being furnished by blast-furnace gases in Germany. The history of this matter is also, in fact, the history of large gas-engines, the last chapter of which has yet to be written. But with regard to these, again, the difficulties are in course of being surmounted; and year by year progress is made. We are told of a Deutz engine giving 2000-horse power shortly to be employed at the Hörde Iron-Works; while another German firm have erected 50 engines aggregating 78,000-horse power for blast-furnace work. In England, apparently the largest hitherto made are of 1000-horse power. In connection with coke-oven gas, which corresponds very nearly in composition to illuminating gas as it is ordinarily manufactured, mention is made of a proposal to heat the coke-ovens with blast-furnace gases. This should be feasible enough, if means were found to regulate the supply according to requirement, and would probably be profitable where the coke-oven gas could be employed to advantage.

The student will find some useful chapters on the theory of the gas-engine—the utilization of heat, and explosion and combustion in a gas-engine, in the latter of which reference is made to the work done by the Gas-Engine Research Committee appointed by the Institution of Mechanical Engineers. Following these, the second part of the volume is devoted to oil and oil-engines. This comprises eight chapters; the last being descriptive of "The Practical Application of Gas and Oil Engines," and accompanied by a table giving particulars of the gas and oil engines used in German and other water-works. Part III. treats of air-engines. The volume concludes with a series of extremely useful tables of tests of different engines with various gases, and also of oil and air engines; ending finally with a Bibliography and Index. With the two latter parts of the volume our readers are less interested than with the first; but as an authoritative text-book upon the subject of internal combustion motors in its entirety, the work has, so far as we know, no equal. Its great value alike to the practical man and the student is quite beyond dispute; and we commend it heartily to all who are interested in the very important subject of which it treats.

One or two trivial errors (possibly due to the printer) may be pointed out. On p. 21 the date of Lebon's first patent is given as 1709, instead of 1799; and on p. 264 the equivalent of 380 cubic metres is stated as 9917 cubic feet.

A POINT REGARDING REDEEMABLE STOCKS.

An altogether unusual amount of attention has just recently been paid to the 3 per cent. redeemable stock of the Tynemouth Corporation, of which there have been two issues—in 1889 and 1893. In each case the prospectus set forth that the stock "was redeemable at par on Jan. 1, 1913;" and in conformity with this declaration, the Stock Exchange Official List has until the last month or two given that year as the date of final repayment, without any question having been raised as to the accuracy of the statement. About the middle of October, however, an alteration was made in the official list; the date of redemption being then for the first time quoted as "1913-1949." This apparently was regarded by the dealers as an unwarrantable proceeding; and their disapproval of it was manifested by the ultimate striking of the quotation from the list, in which it has not since been allowed to appear.

These are the facts of the case as set forth by the "Stock Exchange Gazette;" and in commenting upon them, our contemporary is not sparing in its criticism of the attitude taken up by the Corporation. An inquiry was addressed to the Borough Treasurer, who replied that the stock "is redeemable at par on or after Jan. 1, 1913, at the option of the Corporation," and that "no alteration in the conditions has been made by the Corporation." As an indication, however, of what was previously in the minds of the officials at Tynemouth, it is pointed out that when a proof of the notice regarding the stock which it was intended to include in the "Stock Exchange Year-Book" for 1906 was sent to the Corporation for verification or any necessary correction to bring the information up to date, this was returned as originally forwarded, with the exception of an alteration in the amount of the outstanding debt. In this notice, the following statement occurs: "The principal of the stock falls due Jan. 1, 1913, against which date a sinking fund has to be provided. The sinking fund may be employed in the purchase of stock; and the power has been exercised by the purchase of £12,800 of stock." Assuming—as it seems fair to do, in view of the fact that the proof was duly returned without any modification of the portion referred to—that this is an accurate rendering of the ideas at that time held by the Corporation officials on the subject, it seems clear that some change of position has since taken place.

Our contemporary remarks that the Corporation's contention would appear to be that the term "redeemable" implies the conferring upon them of an option—that, in other words, the suffix "able" gives a wholly different meaning from the more extended expression "to be redeemed." But, if so, the question is asked how it came about that year after year the statement was allowed to go forth that the stock would "fall due" in 1913. The attitude of the Corporation is denounced as deplorable; the writer of the article pointing out that it is a case of investors having taken up the stock on a clear understanding that it was to be paid off at par in 1913, and now being told that they had been deceiving themselves. He says that the Corporation's own resolutions, when deciding on making the issues, laid it down that Jan. 1, 1913, was to be the actual date of redemption; and that the Corporation cannot have been ignorant of the fact that it has been so regarded both in the Stock Exchange and by those who have become investors.

The matter rests there for the present; but the position does not seem to be a very satisfactory one. If the word "redeemable" is open to two such different constructions as have been placed upon it in connection with the stock of the Tynemouth Corporation, it is to be hoped that on future occasions serious efforts will be made to more clearly define the precise terms on which money is being borrowed. It need hardly be pointed out that the approach of the time of redemption of a stock has a direct influence on its value, according to the price at which it is to be redeemed. The "Stock Exchange Gazette" is of opinion that the present dispute will serve to bring about a radical change in the public estimate of all corporation stocks of the redeemable class. This would be a very great pity; for local governing bodies have not of late found it so easy to borrow the huge sums they stand in need of, that they can afford to do anything likely to still further increase their difficulties. It should not be impossible to find a means of obviating all risk of such a misunderstanding as has arisen in the present instance.

A STANDARD OIL-LAMP FOR GAS-WORKS PHOTOMETRY.

By Arthur H. Elliott, Ph.D., F.C.S.

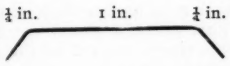
[Engineer-Chemist to the Consolidated Gas Company of New York.]

About a year ago, I took up the study of the question What shall we give the men in the works as a guide to the candle power of the gas they are making? The result of many and varied experiments is the production of a lamp which, in its crudest form, gives an unexpectedly steady volume of light during a period of from ten to twelve hours. The first experiments were made with small glass lamps, burning kerosene (paraffin) oil, and of the cheapest forms of construction. It was soon found that these gave an uncommonly steady light even when some of the conditions pertaining to their use were varied considerably. It was found that the level of the oil in the lamp reservoir could be lowered an inch without making more than two-tenths or three-tenths of a candle difference in the value of the flame. Further, the form of the wick, while changing the shape of the flame, does not materially affect the candle power; and, what is even more important, it is not necessary to trim the wick every day that the lamp is used—every two or three days being often enough for all practical purposes.

Beginning with glass lamps having woven wicks five-eighths of an inch wide and giving 5 or 6 candle power, the experiments were continued until it was found that a wick 1½ inches wide was the most suitable. Wicks an inch wide will give candle values varying from nine to eleven; but it was found better to use a larger flame and then screen off the upper part of it. It is not necessary to give the details of many experiments, covering a period dating back to last April, but in describing the lamp in its latest form, it will soon be seen that not only have we here a very good works standard as a guide to the manager from hour to hour, but we can refine the construction of the lamp, so that it may be ultimately used as a standard for all photometric observations. I will now describe the most useful form of lamp, and the first attempts at making it a reliable secondary unit of light.

As will be seen from the illustration, the body of the lamp consists of a large reservoir with continuous feed (the student lamp principle), and capable of supplying oil to the burner for twelve hours. It holds a little over one pint (500 c.c.) of oil, and the rate of consumption is about 42 grammes per hour. The wick and burner are of the flat-flame type; and the flame produced is remarkably constant in height and illuminating power, and very much less sensitive to air currents in the room than any argand or other round wick flame. The wick is 1½ inches wide, and of the woven cotton fabric usually made for this purpose. Felt wicks may be employed, but they do not give a constant height of flame for so long a period as cotton wicks. The level of the oil in the lamp is 3 inches below the top of the wick tube.

One of the most important points about the wick is the character of the trimming when first started. This should be done with a sharp, rigid pair of scissors. After cutting straight across, the two corners of the wick should be clipped off ¼ inch—thus:



If this precaution is not taken, the flame will burn with two long points at the outer ends, and cause long tails that produce smoke and may crack the glass chimney of the burner. A good plan is to have a form made of thin sheet brass as a pattern for trimming the wick, and always cut the end to suit the pattern. It is quite easy to do this. When starting with a perfectly new wick, it is well to singe the fluff from the top before putting it into the oil in the lamp; and a slight carbonizing of the end of the wick with a small gas-flame also facilitates the formation of a good flame. A little care taken at this point insures days of comfort in the future use of the flame, which is then remarkably constant in both form and height.

Of course, the chimney of the burner is a most important element. Slight changes in the height and the diameter of the top produce slight changes in the candle value of the flame. A high chimney will give a high candle value, and *vice versâ*. But it is perfectly easy to get lamp-chimneys that are constant in height and upper diameter; and the form of the enlarged part of the chimney does not appear to be important, provided it is quite large. The chimney I have used is what is known here as No. 40 Macbeth pearl glass. It is 1¾ inches inside diameter at the top, 3 inches outside at the bottom to fit on the burner gallery, 4 inches at the largest diameter, and 10 inches high. These chimneys rarely break, and last months with reasonable care. As the illustration shows, there is an adjustable sheet-iron screen covering the upper part of the flame, which screen is supported upon two upright brass strips riveted to the burner-shell. When this screen is set at from seven-eighths to an inch above the brass cap of the burner through which the flame burns, the lamp will give from 12½ to 13 candle power.

As it is necessary to standardize the oil-lamp with standard candles, for practical purposes it is not important to adjust the screen to any particular candle value. But having determined the value of the flame between the screen and the burner-cap, it will be found to remain exceedingly constant during ten or twelve hours of burning. It burns from ½ inch to ¾ inch higher behind the screen. Of course, it is possible to screen to such a point as to give a 10-candle standard. This I am working at, and hope to produce an oil-lamp standard fully equal to the pentane lamp, and very much simpler and far less dangerous from an insurance point of view. The 10-candle point is about ¾-inch above the burner-cap.

In order to give some of the capabilities of the lamp, I send the following figures taken from my records of its workings:—

Lamp against Standard Candles.

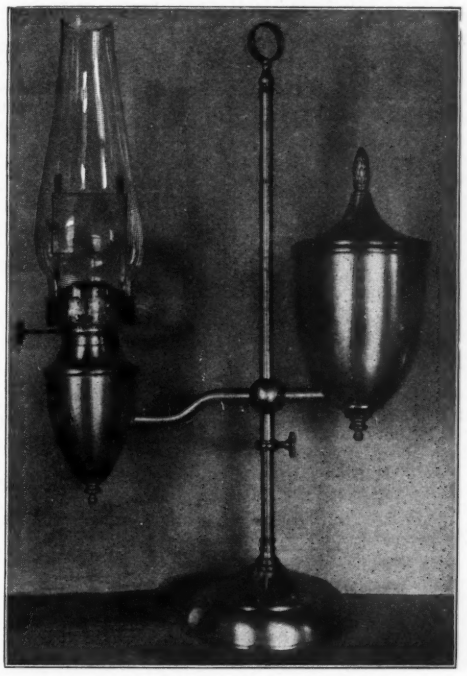
Candle-Power of Lamp.	Without Iron Screen.	Burning Continuously.
10 Minutes.	1½ Hours.	3 Hours.
11·76	12·51	12·60
5 Hours.	6 Hours.	
11·67	11·49	..

This was one of the first experiments made. It showed that perhaps the lamp was not burned long enough before testing, and that a slight adjustment of height of flame was necessary. The flame was adjusted to a wire placed 1½ inches above the cap; and another test of the same lamp gave—

30 Minutes.	3½ Hours.	5½ Hours.	7 Hours.
15·09	14·96	14·83	14·52

It will be seen that the flame without the screen does not always give the same candle value when relighted; but it remains constant after being started.

In order to get at the constancy of the flame against something which may be taken as quite uniform, a pair of photometer holders were filled with the same gas (5 cubic feet in each), and the lamp was set up as a standard—the gas rate being 5 cubic feet per hour, and the lamp value equal to 11·93 candles as tested against candles. Five different observers took the candle power of this gas during four hours of burning, and when the temperature of the photometer room remained within a few degrees of being constant. The candle power of the gas by each observer was as follows (some of them, however, being not over expert at the work): A, 21·92; B, 21·92, 22·66, 22·66; C, 22·66, 22·66; D, 22·66, 22·66; and E, 22·66. The various observers kept the figures until the end of the series of tests, when notes were compared. It is unnecessary to call attention to the conclusions drawn—the lamp is practically constant for a number of hours.



Photometer Lamp—12½-Candle Power—Used April, 1905.

A large number of experiments of this kind were made, using different kinds of oil of about the same grade (Pratt's astral oil), and no material difference was detected in the constancy of the results obtained. Some of the most interesting experiments were made using different kinds of standard candles; some imported several years ago and others purchased quite recently. These were tested against gas and with the lamp, and proved beyond question that the lamp gives a more steady illuminating value than candles, although these were found to be quite good. As compared with the pentane lamp, the oil standard is fully as steady, is much easier to adjust, and far less dangerous. In my hands, the pentane lamp is not steady, and will vary in candle value from hour to hour and according to the temperature of the room and the moisture in the air. In cold weather, pentane is quite troublesome.

It having been proved that various kinds of pentane of different boiling points all give the same value in the pentane lamp, and

when mixed with air, then why should not heavier petroleum products give a constant candle value when properly burned? The experiments made here seem to force to this conclusion. A very great advantage of using a liquid hydrocarbon like kerosene for this work is that a barrel of the oil can be standardized for use in the lamp as above described, and thus serve for testing over a period covering many months. The Pratt's astral oil used in the experiments made here had a specific gravity of ·7756 = 505 Be; and gives on fractional distillation the followiug results:—

Begins	300°–400°	Fahr.	50·8 per cent. distillate.
	400°–500°	,,	41·2 ,, ,,
	500°–650°	,,	8·0 ,, ,,

Another poorer grade of kerosene was used with the same results as to candle value in the lamp; and this oil gave the following results: Specific gravity ·7865 = 481 Be; and on fractional distillation gives:

Begins	305°–400°	Fahr.	36·2 per cent. distillate.
	400°–500°	,,	39 2 ,, ,,
	500°–700°	,,	24·6 ,, ,,

Since these two varieties of oil give practically the same results in the lamp, it is easy to see that pretty wide differences in the density and volatility of the oil have little influence on its illuminating value for photometric purposes. But it is, of course, advisable to use good oil of standard grade; it looks cleaner and cuts off any chance of variability when purchasing new supplies.

In closing this article, I would summarize as follows: The oil lamp is a clean and quite accurate standard of light for all practical purposes. It is remarkably constant over pretty long periods of use. It need not be trimmed daily. If the flame has a good shape, better not trim it; a lamp has been used five days without trimming. When burning after first use, simply remove charred end of wick and do not cut down into the fibres of the wick itself. Use a brass metal form to cut the wick at start, also to keep it in good form. This same form may be ¾ inch wide and serve as a gauge to the height of the flame-screen above the burner cap, giving practically 10-candle power value to the flame. Although the wick-tube is 1½ inches wide, the flame burns from the one inch end that rises first in the tube; it being better to use a 1½ inch wick trimmed to one inch, because it is easier to raise or lower the flame uniformly. It is not necessary to have a screen at the lower end of the flame and on the burner-cap. This was tried and abandoned, since it changed the air currents and diverted the flame from the vertical line.

As I close, I will give some figures just obtained with the ¾ inch 10-candle screen. At the beginning of the test, the lamp against candles gave 10·20 candle power. Four-and-a-half hours later, the same lamp and candles gave 10·26 candle power. The lamp burned continuously during these four-and-a-half hours. After twenty-four hours, the lamp was lighted again with the following results: At lighting for after fifteen minutes it gave 10·44 candle power; after one-and-a-half hours, the candle power was 10·34; after three hours, it was 10·33; and after four-and-a-half hours, it was 10·41. In each case the lamp was burning continuously; and in the last instance the oil was very nearly exhausted in the reservoir of the lamp. The total height of the flame, however, remained constant.

REMOVAL OF NAPHTHALENE FROM COAL GAS.

By William Young.

As remarked in my former communication on this subject, the prominent features of Messrs. White and Ball's communication to the Michigan Gas Association in 1904 was the account of the results of their careful experiments to ascertain the weight of naphthalene that could be taken up and held in diffusion through gas at different temperatures; and that of last year, by Messrs. White and Clary, the account of the equally careful, though not so reliable, experiments made to ascertain the weight of naphthalene that could be taken up and held in solution by various samples of coal tar at different temperatures.

There is no doubt but that the relative diffusability of the naphthalene as vapours through the gas, and their solubility in the tars under the various conditions obtaining in the condensing process, constitute the main factors to be studied in arriving at the solution of the naphthalene problem by what has been described as the natural solvent the tar. What strikes one on reading over the latter report, and what, judging from your Editorial remarks regarding the same must have impressed you, is the surprisingly illogical deductions drawn by Messrs. White and Clary from the results of what they appear to believe to have been an original observation on their part, and which they describe as an unexpected fact—that the power of the tar to dissolve naphthalene increases with the temperature; and it has occurred to me that the following remarks, supplementary to the able and highly scientific articles which appeared in your pages from the pen of Dr. Colman, but on a lower and more practical plane, may be helpful in the matter. I am further prompted to do so, as I observe that these erroneous deductions from the results obtained by Messrs. White and Clary are being accepted and claimed as confirmatory in a notable manner of the correctness of the views that are enunciated by some of those taking a prominent part in the introduction of naphthalene process in this country.

Everyone who has had anything to do with coal-tar distillation, or even only dealing with the distillates—particularly creosote oil—must have observed, and have been aware, that the power of these naphthalene solvents to dissolve naphthalene increases with the increase of temperature—that creosote oils which are perfectly liquid at high temperatures and showing not a trace of naphthalene in solution, become thick with deposits of naphthalene crystals that cannot be held in solution at lower temperatures, and that, on again heating up the pasty mass, it gradually becomes thinner as the crystals of naphthalene are taken back into solution by the solvents as the temperature rises. Further, it is a common practice with those selecting a solvent for naphthalene, to test their solvent power by adding a weighed quantity of crystalline naphthalene to the solvents, gradually raising the temperature, stirring, and observing at what temperatures the successive amounts of naphthalene are taken up in solution—verifying, if thought necessary, by subsequent cooling, and observing at what temperature the naphthalene crystals begin to be deposited; and it is common knowledge that the power of all the liquid hydrocarbons present in coal tar to dissolve naphthalene increases with rise of temperature.

As everyone now knows, it is the solvents present in the coal tar that dissolve the naphthalene out of the gas during the process of condensation; and Messrs. White and Clary, in making their experiments to ascertain the solvent powers of tars for naphthalene at different temperatures, made a practically equivalent test to that to which reference has just been made—the only essential difference being in the method of conveying the weight increments of naphthalene to the tars at the different temperatures. They placed in a bottle or other vessel the weighed sample of the tar whose solvent power they wished to ascertain, along with such a quantity of crystals of naphthalene contained in a thimble—a little more, as they thought, than the tar could take up in solution at the temperature at which the test was to be made; the whole being hermetically sealed.

Now, on heating the sample of tar and naphthalene enclosed in the bottle, the naphthalene would at once begin to volatilize into the surrounding air contained in the bottle; in other words, the air would take up the naphthalene vapours in diffusion, or what may be expressed as in gaseous solution, and if there had been nothing present in the bottle but the air and the naphthalene, the air would very soon have taken up in gaseous solution all the naphthalene it could at a definite and fixed temperature, and become saturated. But in the case of the experiments, the air so saturated would be carried by convection currents and by the force of diffusion over, and brought into contact with, the surfaces of the contained solvent tars; and, as is well known, the tars would absorb a part of the vapours or gaseous naphthalene from the saturated air, reduce them to the liquid state, and take them up in solution. The air thus denuded of parts of its naphthalene vapour, would in turn be carried back by convection currents again over the surface of the naphthalene, the vapours from which would volatilize into it and be taken up in gaseous solution; and the air thus resaturated would convey and part with a further portion of naphthalene vapour to the solvent tar. This process would continue till the air had, in the manner described, carried to the solvent tar as much naphthalene as it could take up in solution at the temperature at which the test was made; and the air would then also remain saturated with naphthalene vapours. On re-weighing the tar, the increase in the weight would show the weight of naphthalene that had been so carried by the air, and taken up in solution by the tar, at the temperature of the experiment.

Such would have been the conditions of the experimental test if the sample of solvent tar did not contain volatile substances. Owing to such not being the case, Messrs. White and Clary admit that the results they obtained were not absolutely correct, but that the error was so small that, after making a series of experiments at different temperatures, they came to the conclusion that: "It may be accepted that tars can absorb more naphthalene, and absorb it more rapidly at higher temperatures up to at least 161° Fahr. than at lower ones; that tar at 161° Fahr. can hold more than five times the amount of naphthalene which it can hold at 77° Fahr.; that, for the purpose of naphthalene removal, it is better to scrub the gas with hot tar." Is this a logical deduction to make from the results of the experiments we have just considered? I think not. It appears to me that the false deduction arises from confounding, or rather overlooking, the fact that the conditions which will enable the tars to dissolve and hold in solution are not necessarily those which will enable the tars to absorb naphthalene vapours from the gas.

We have seen that, to enable the samples of tar experimented with to absorb the amount of naphthalene at the respective temperatures referred to, it was essential that the samples of tar, the thimble of naphthalene crystals, and the enclosed air, should be raised to the same temperature. It is therefore obvious that, to enable the sample of tar to absord the naphthalene vapour from the air, it was necessary that the air should be kept saturated with naphthalene vapours.

In the experiments made by Messrs. White and Clary, to ascertain the amount of naphthalene present in the samples of tars filtered out of the samples of gas from the stand-pipes, hydraulic main, &c., they subjected them to an inversion of the conditions obtaining in the experiments made by them to ascertain how

much naphthalene the samples of tar could absorb and hold in solution—that is, instead of making the air pass over the surface of crystalline naphthalene, take it up in gaseous diffusion and carry it to the sample of warm tar to be absorbed and dissolved, they placed the tubes containing the asbestos and glass wool upon which the tar had been deposited from the gas, in a chamber or oven heated up to a temperature of about 161° Fahr. Through the tube, over the surface of the tar so heated, they slowly aspirated the warm air from the oven. Into this air the naphthalene in the sample of tar spread over the surface of the asbestos volutilized, and was carried away by the air in gaseous diffusion, to be frozen out in a U-tube placed in iced water as naphthalene crystals, which were subsequently weighed.

Seeing Messrs. White and Clary believed that tar at 161° Fahr. could hold more than five times the amount of naphthalene which it could at 77° Fahr., why, when they wanted to loosen that hold of the tar for the naphthalene, and enable the air to take it up and carry it away, did they warm the sample of tar and the air to be passed over it? Simply because they also knew that, while the power of the tar to dissolve and hold in solution naphthalene was more than five times the amount at 161° Fahr. that it was at 77° Fahr., yet the power of the air to take up and hold the naphthalene in gaseous diffusion was not merely five, but more than thirty times as much at 161° Fahr. as at 77° Fahr. We thus see that Messrs. White and Clary's reason for so conducting their experiments was that the balance of the two forces—that of the tar to dissolve and hold, and that of the air to take up and hold, naphthalene in gaseous diffusion—was largely in favour of the air at the higher temperature.

In the process of scrubbing gas with tar, both these forces came into full play, and one would have expected that, in estimating the best conditions under which the tar could be applied to scrub the gas in order to almost completely remove the naphthalene vapours, Messrs. White and Clary would have given due consideration to the value or power of both these forces; also that they would have appreciated the fact that while the power of both the tar to take up and hold naphthalene in solution, and the gas to take up and hold naphthalene vapours in gaseous diffusion, increased with the rise of temperature, yet the power of the gas to take up naphthalene increased at a much higher rate than did that of the tar to absorb and hold the naphthalene in solution, and, therefore, that, at the higher temperature, the balance or equilibrium of these two forces would be in favour of the gas to hold the naphthalene vapours in diffusion against the solvent power of the tar. In other words, at the higher temperature the extra solvent power of the tar was more than counterbalanced by the extra power of the gas to hold the naphthalene vapours in diffusion; and as there is never in the ordinary practice of carbonization of coal sufficient naphthalene produced to saturate both the gas and the tar at the higher temperature, the total naphthalene present must be held divided between the tar in solution and the gas in diffusion in proportions bearing a relation to these respective forces. Therefore the gas will hold at the higher temperature a larger relative proportion of naphthalene than at a lower temperature.

On the other hand, seeing that the solvent power of the tar while falling with the fall of temperature yet falls far more slowly than does that of the gas to hold on by the vapours of naphthalene, and, further, seeing that at lower temperatures the power of the gas to hold the vapours of naphthalene is extremely small, while that of the solvents present in the tar to absorb and dissolve naphthalene is still very considerable, it follows that at a certain temperature—dependent upon the amount of tar, the naphthalene present, and the volume of gas—the absorbent and solvent power of the tar will overtake and become equal to the power of the gas to hold the naphthalene vapour in diffusion, and that a further fall of temperature will turn the balance of the two forces in favour of the solvent power of the tars, enabling them more perfectly to absorb and remove the naphthalene vapours from the gas. It will thus be seen how erroneous is the deduction drawn from the results of the experiments by Messrs. White and Clary—that, during the process of condensation, the tars can absorb from the gas such a quantity of naphthalene vapour at the higher temperature as to cause them to give back to the gas at a lower temperature the vapours they have previously absorbed. As is well known, the very reverse would be the case. Tars travelling in the same direction in contact with the gas till cold would gradually absorb more and more naphthalene vapours from the gas as the temperature fell, and, *vice versa*, tars allowed to absorb all the naphthalene vapours they are capable of doing from the gas when cold will, on being made to travel back against the current of hot gas and products, give up to the warm gas a part of the naphthalene they had previously absorbed, just as, as has been already explained in the case of the experiments, did the samples of tar deposited upon the asbestos and glass wool give up to the warm air the naphthalene they had previously absorbed.

The process originally brought before the gas industry by Messrs. Glover and myself for preventing naphthalene deposits by diffusing through the gas the vapours of naphthalene solvents having a similar vapour tension to that of naphthalene, is a good illustration of the application of the observed relation between that of the solvents to dissolve, and that of the gas to hold, naphthalene vapours in diffusion. By that process the gas is used to carry sufficient solvents to take up the whole of the naphthalene in solution when it can be no longer held in diffusion by the gas at the lower temperature. The other experiments made by Messrs. White and Clary to determine the relative proportions of the naphthalene held diffused through the coal gas in the state of vapour and that present in the solvent tar as fog mechanically suspended in the gas at different points in the cooling and condensing process, and which they adduce as further evidence of their view that hot tar removes naphthalene more completely from the gas than when cold, have already been most ably considered and dealt with by Dr. Colman in his contribution to your pages. My own experience fully confirms his—that the conditions obtaining in the methods of making the experiments do not furnish the correct proportional division of the naphthalene between the tar fog and the gas, partly for the causes Dr. Colman explains, but also for another, to which I may be allowed to refer.

If the sample of gas and mechanically suspended tars drawn off and used in the experiments had been condensed in the usual manner, the tar and gas would have been cooled together in contact with each other in the amounts and volumes in which they were produced from the coal, and then separated for good. In the case of the experiment, however, the gas was cooled in contact with the tar, so as to allow the tar to have a greatly increased solvent action; for it will be observed that, instead of being allowed to flow away from contact with the gas as precipitated, the tar was filtered out of the gas and left deposited on the large surface of the asbestos and glass wool in the filter-tube. The gas first passing through the tube would be the only portion subjected to the solvent action of its own tar. The next portion would not only be subjected to the action of its own tar, but also to the solvent action of the tar deposited from the previous portion; and each successive portion of the gas would thus be subjected to the solvent action of an increased proportion of the tar, until, before the termination of the experiment, the last portions of the gas passing the filter-tube was being subjected to the solvent action of an amount of tar possibly a thousand times greater than that which was produced along with it from the coal. Even although, as Dr. Colman points out, every precaution was taken to retain the filtering-tubes at the temperature of the experiment, yet there is no doubt the temperature in these tubes did fall during the experiment, particularly in the case of those at the higher temperature. The results from these are most important in their bearing upon the point at issue; and there can be no doubt the conditions obtained in the experiments did allow of the tars exercising a greater solvent effect for the naphthalene than they would have whilst suspended in the gas at the point in the condensing plant from which they were withdrawn. I can cordially agree with Dr. Colman in his summing up that: "There is no justification for Messrs. White and Clary's hypothesis that hot tar absorbs naphthalene from coal gas more completely than cold tar, but that it is contradicted by many known facts, and is not really borne out by their own experiments."

In my last communication, and on various former occasions, I have explained my views regarding the action of the physical laws that come into play during the process of condensation, and, in later years, more particularly the action of the tar upon the naphthalene present in the gas. I am pleased to see from Dr. Colman's recent communication that he is continuing his investigation, and also to learn from your "Editorial Retrospect" for the past year that the Gaslight and Coke Company have generously placed at the disposal of the Committee of the Southern District Association their Silvertown works for the further prosecution of the research work on the subject under the able guidance of Dr. Colman. From the conversation I have had with him, and his writings upon the subject, I know of no one better qualified to carry on such research work on sound principles; and I feel fairly confident that the further research work into the actual conditions most advantageous for the removal of naphthalene from coal gas, by what has been described as the natural solvent of the tar during the process of condensation, will go to support and confirm the soundness of the principles enumerated by Messrs. Glover and myself in this regard, just as surely as the processes now so successfully in operation in many works in England and upon the Continent—in which a supplementary, or what may be described as an artificial, supply of suitably prepared hydrocarbons fluid solvents are employed to prevent trouble from naphthalene deposits, by washing the naphthalene out of the gas or by curburetting the gas with the vapours of naphthalene solvents having a similar vapour tension—go to support and confirm the soundness of the original research work of Messrs. Glover and myself, and of the principles of the processes that were originally brought by us under the notice of the gas industry.

The behaviour of naphthalene is no longer the mysterious puzzling problem it was eight or ten years ago. We now know the fundamental principles underlying its solution, by the use of solvents natural (tar) and artificial (tar and other hydrocarbon distillates); and the best methods of applying these principles are being rapidly evolved in practice. The problem still remaining for further research and elucidation is the subject referred to by Professor White in closing the discussion at the Michigan Association meeting, and to which I also made allusion in the article contributed to your pages in March last*, that of the conditions obtaining during the carbonizing process, contributing

* See "JOURNAL," Vol. LXXXIX., p. 706.

to, or lessening, the production of naphthalene from coal gas. There cannot be any doubt but that the gas and products from a given coal can be greatly modified by the methods of its carbonization—more particularly the mechanical and hydroscopic conditions of the coal on being charged into the retorts or other carbonizing and gasifying arrangements, the methods and temperatures of the heat applied to the elimination of the volatile matters from the coal, and the cracking up of these volatile matters after being liberated.

In the carbonization of shale for the production of paraffin oil when, in order to obtain the best and most economical results in oil and ammonia, it was necessary to subject the shale and the residual coke to a fractional process—so that heats of different temperatures could be fractionally applied to perform different functions; and also, so that the heat should be as fully and as economically used as possible with the least cost of manual labour—vertical retorts have been found to possess many advantages. Along with others, I have lately been giving consideration to the subject of the carbonization and gasification of coal in modified forms of vertical retorts such as those I have long had experience in using in connection with the shale industry; and I feel fairly confident that some good, practical trials of such modified forms as these arrangements will be found to be equally advantageous in connection with the gas industry.

THE NEW INSTRUCTIONS OF THE METROPOLITAN GAS REFEREES.

By H. Leicester Greville, F.I.C., F.C.S., &c.

It may not perhaps be too much to state that no more important document has been published for many years than the last notification of the Metropolitan Gas Referees. The prescriptions of testing are what might be aptly described as quite a revolution, although, like all revolutions of a peaceful character, the result of evolution. The changes which have been brought about are the outcome of the smouldering embers of injustice, from which gas companies have long suffered, and which have now culminated in radical changes of procedure. When contending parties have acute subjects of dispute, the usual procedure (where arbitration is possible) is a compromise. In this case, I consider that the gas companies are to be congratulated on having secured what may be regarded as reasonably favourable terms. There is no doubt that the abrogation of legal penalties for sulphur excesses, and the modification of the test for sulphuretted hydrogen, so as to make the conditions of testing less stringent, are only what is just and right, as also the modification of testing for illuminating power. All this should have been recognized many years ago; but it was only when the leading gas companies took combined action that sufficient pressure was brought to bear upon the whole question in a form to demand prompt attention.

With regard to the new notification, it is noticeable that, not only is there no official testing for sulphur compounds, but ammonia testing is also abrogated. Out of four original possible penalties, two only remain; and these two are so modified as to be reasonable instead of unreasonable tests. In the test for sulphuretted hydrogen, it is to be noted that the test-slips are exposed to a current of the gas, but the gas does not directly impinge upon them. Moreover, a three minutes' test at about 5 feet per hour is considered sufficient. The test is therefore limited to 0·25 cubic foot of gas. I cannot gather from the instructions how many slips of test-paper are to be used at a time; but this would certainly affect the test to a small degree. The more slips, the greater the absorptive capacity, and the less possible effect on each individual paper.

With regard to lighting power, the new burner and the prescription for using it appear, *prima facie*, to be just and reasonable. But information is, as far as I know, lacking as to what is the actual difference in illuminating power on different grades of gas by the new as compared with the older method of testing. At least, I have not seen any published records on the subject. This much is at least certain—viz., that an adjustable air supply is the only scientific method of dealing with different qualities of gas consumed at a fixed rate, in a prescribed burner, with a definite size of chimney; and this question has long been recognized on some parts of the Continent. Under the conditions for the use of the new burner, the rule for regulating the proportion of air supply appears to be all that could be required—viz., checking the air to almost the smoking point of the burner, and then admitting just a sufficiently increased quantity to prevent the actual tailing of the flame.

It may be an open question whether, with an air supply capable of accurate adjustment, a slightly taller chimney than one of 6 inches might not have been advisable. But with such a concensus of opinion in its favour—the Gas Referees and the Gas Companies—there is no doubt all questions affecting the efficiency of the burner have received the most careful attention. With regard to correction of the gas for temperature and pressure, I note that the aerorthometer is still retained, subject to periodical comparison with actual barometric and thermometric readings. I do not wish to say anything against the aerorthometer; but my own personal experience in its use, as well as the observations of many gas examiners with whom I have come into contact, have not shown it to be very satisfactory.

The concession to the gas company as to the lighting power to be a mean (under the specified conditions) of three days should prove most valuable, though from a consumer's point of view not altogether satisfactory. A deficiency of a candle in the light on one particular day does not appear to me to be compensated for by an extra amount on two other days. It seems to me that the gas examiner of the future is likely to have a busy time. Tests for sulphur compounds, illuminating power by a flat-flame burner, and determinations of calorific value are to be made on such days as the controlling authority shall direct. The London County Council, at least, will not be likely to abandon their long-established position as carping critics, but will probably avail themselves to the full of the possibilities of ascertaining what course of action the nefarious gas companies are pursuing with regard to their gas outside the domain of the possible infliction of pains and penalties; and it is to be hoped that the gas examiner will be duly remunerated for the extra demands made on his time and skill. No doubt a very valuable set of figures will be obtained by repeated tests—more especially with regard to the relation between the illuminating power of gas and its calorific value. This investigation will be on an entirely new basis, in which a possibly more perfect form of calorimeter than those previously in vogue will be employed; while the lighting power will be determined by the new burner. The results may be looked forward to with the greatest interest.

FLUELESS GAS-STOVES AND THEIR EFFECTS ON THE ATMOSPHERE OF ROOMS.

By E. D. W.

A surprising development in the use of gas for heating purposes has been the rapid extension during the last few years of the number of condensing or flueless gas-stoves. These stoves, made originally in small sizes and with luminous burners, were then recommended only for use in well ventilated positions; but their descendants of the present day, although enormously increased both in their actual dimensions and as to gas consumption, and frequently fitted with a bunsen burner heating hollow-fuel to incandescence as in an ordinary gas-fire, are now being fixed in positions in which there is no specially free ventilation—such as offices, schools, waiting-rooms, &c. Made now in a great variety of patterns and sizes, and with the fire itself visible or enclosed, they seem to get over the difficulty of warming those rooms which cannot conveniently be fitted with an outlet for the products of the combustion of the heating agent. There can, in fact, be but one objection to their use—viz., that the combustion of gas produces carbonic acid and water vapour; and the former of these is not usually considered a desirable constituent of the atmosphere, from a hygienic point of view.

It becomes necessary, therefore, to investigate the objection due to the presence of carbonic acid gas in the air of the heated room; and this can best be effected by noting the actual quantity of carbonic acid produced by the combustion of a given volume of gas. For the purpose of this argument, the average composition of coal gas will be sufficiently accurate if taken thus:

Hydrogen	50 per cent.
Light carburetted hydrogen	36 ,,
Unsaturated hydrocarbons, olefiant gas, &c.	4 ,,
Carbonic oxide	6 ,,
Nitrogen, &c.	4 ,,

The combustion of 100 cubic feet of this gas will be found to require about 115 cubic feet of oxygen, or (say) 575 cubic feet of air; the products of the combustion being (say) 50 cubic feet of carbonic acid and a quantity of water vapour, which, being mostly condensed, can be passed over for the present.

From these figures it will readily be seen that, with a stove consuming 20 cubic feet of gas per hour, 10 cubic feet of carbonic acid are being added to the atmosphere and 23 cubic feet of oxygen used hourly. There will thus be an actual loss of pressure in the atmosphere of the room due to the replacement of 23 cubic feet of oxygen by only 10 cubic feet of carbonic acid. [It is, of course, assumed that the whole of the water vapour formed by the combustion is condensed.] This difference of 13 cubic feet will be filled by that quantity of air from the outside, one-fifth of which (or 2·6 cubic feet) will be oxygen. If, now, it is assumed that there is no ventilation in the room in which the stove is fixed, except that induced by a slight vacuum as explained above, and if it is further assumed that the dimensions of such a room are 20 ft. by 20 ft. by 10 ft., or 4000 cubic feet, the use of the condensing stove will involve the following alterations in the composition of its atmosphere:—

	Nitrogen.	Oxygen.	Carbonic Acid.
When stove is lighted	3200 c. ft.	800 c. ft.	—
After 1 hour's use	3210 ,,	780 ,,	10 c. ft.
After 2 hours' use	3220 ,,	760 ,,	20 ,,

And so on; the atmosphere losing 20 cubic feet of oxygen for every hour, and gaining 10 cubic feet of nitrogen and 10 cubic feet of carbonic acid.

As a matter of fact, it would be quite impossible to find a room so utterly without ventilation as that imagined above. Rooms, fortunately, have to be furnished with doors, and mostly with windows; and there is sure to be a certain amount of accidental ventilation from these. Moreover, if the room has a boarded floor, there will be spaces between the boards; and the ventilation through these is of a particularly useful description, as the high specific gravity of the carbonic acid will make it tend to fall through.

The loss of oxygen stated above amounts to 0·5 per cent. per hour—that is, the oxygen starting at 20 per cent. of the total atmosphere is reduced to 19·5 per cent. at the end of the first hour, *if there is no ventilation*. It will, however, be apparent from the figures given, that a room ventilated by an ordinary allowance of doors and windows, especially if the former are opened frequently, is not likely to have its atmosphere seriously vitiated by a condensing gas-fire. It will be noticed also that it is assumed that the whole of the water vapour is condensed. This will be the case when the air of the room becomes saturated with water vapour, though a portion will issue from the stove as vapour; and, unless there is sufficient ventilation to carry it away, will condense in the room, preferring the coldest surfaces, such as windows.

Another factor which has a strong bearing on the subject is that a portion of the carbonic acid formed by the combustion is taken up by the water as it condenses and runs down the tubes of the stove. The quantity of carbonic acid thus absorbed will doubtless vary considerably under different conditions—the length of tube which has to be traversed by the products of combustion being the principal factor. It is always considerable, and is therefore a strong point in favour of the condensing stove. The sulphur compounds in the gas will also be taken up by the condensed water being burnt to sulphur dioxide in the flame, which gas, on coming into contact with the water in the tubes, forms sulphurous acid, which again is oxidized to sulphuric acid on exposure to the air.

It will thus be seen that the only product of combustion which really affects the atmosphere is a portion of the carbonic acid. There is an unreasonable prejudice existing in the lay mind against this gas—it is commonly spoken of as "poisonous;" and it is, of course, quite true that it is the principal constituent of the "choke-damp" of wells, &c., and the "after-damp" of coal mines. As a matter of fact, its chief offence against animal life is that it is not oxygen, and that its presence usually (though not necessarily) means that the percentage of oxygen present in an atmosphere is diminished. Carbonic acid is, in fact, a poison of the negative, or passive, description; and although an animal in an atmosphere of pure carbonic acid would die in a very short time, it must always be remembered that the same thing would happen with pure nitrogen. It is, therefore, a mistake to value an atmosphere by the percentage of carbonic acid present; the really vital consideration is the percentage of oxygen. In confirmation of this view of the harmlessness of carbonic acid, it may be well to mention that the deaths in coal mines caused by "after-damp," which used to be attributed to carbonic acid, have been shown to be due to carbon monoxide, which is also present in the "after-damp," though in a very small proportion to the carbonic acid.

A consideration of the nature and quantities of the products of combustion which are likely to pass into the atmosphere from a condensing or flueless gas-stove will, therefore, lead us to the conclusion that there can be no risk to health in the great majority of the positions in which they are fixed. In fact, it would be simpler to mention the few conditions which render the use of flueless stoves inadvisable, than to enumerate the many circumstances under which they are quite innocuous, as far as vitiation of the atmosphere is concerned, and more efficient than any stove fitted with a flue, in heating effect per cubic foot of gas used. The conditions to be avoided then, are, firstly, any obviously badly-ventilated room, particularly if, in addition to the stove, artificial light has to be used during the daytime; secondly, any room with a large number of occupants relative to its cubical contents, unless there is some good and absolutely certain method of ventilation; and, thirdly, a dwelling room occupied by perhaps few people, but these likely to remain in the room for comparatively long periods and without much ingress and egress. Here, again, the objection need not hold good if there is an efficient ventilating system.

Referring to the second condition under which it is contended to be inadvisable to fix a flueless stove, it must be remembered that each human being produces, on an average, about 0·75 cubic foot of carbonic acid per hour. So that if a large number of people are at work in a factory with a limited number of cubic feet of space to the individual, there already exists a percentage of carbonic acid in the atmosphere, to which it would be unwise to add. When it is further pointed out that, with the carbonic acid given off from the human frame, there also come germs and particles of *débris*, both from the lungs and the skin, it will readily be agreed that what is required is an addition to the ventilating power, and, consequently, a stove with a flue is indicated.

Of the flueless gas-stoves, those fitted with bunsen or atmospheric burners are undoubtedly better than those in which the gas burns with a luminous flame; for in the latter case there is always some risk of a small quantity of carbonic oxide appearing among the products of combustion, owing to the latter being incomplete. Even an infinitesimal percentage of this gas in the atmosphere is a serious matter, and it is always as well, therefore, to use a bunsen burner, in which the copious air supply makes its production a practical impossibility. Whichever pattern of burner is employed, it should be fitted with a governor, to prevent the consumption varying with alterations of pressure on the district.

It is probable that, with their extended use, there will be considerable improvements in flueless gas-stoves in the near future. Among these, will perhaps be some method of taking up chemically—say by lime—a larger portion of the carbonic acid produced. This could probably be best effected in the tubes. But as the stoves are made at present, a little caustic potash added to the condensed water in the pan will have a considerable effect, and at very trifling cost. This, however, necessitates the use of an earthenware or vitreous-enamelled pan. If something of this sort were carried out, it would greatly help to reduce the prejudice which still exists in many minds against anything "flueless;" and full advantage could then be taken of the increased heating effect per cubic foot of gas obtained by these stoves.

THE "BLAND" INVERTED LIGHT.

Tests made by an authority on incandescent gas-burners ascribe to this new inverted burner a high efficiency. At 15-10ths pressure and a consumption of 2½ cubic feet of gas per hour, the illuminating power is stated at 56 candles; at 27-10ths pressure and a shade under 3 cubic feet consumption, at 80 candles; and at 7 inches pressure, at 125 candles. Used with such a range of pressures as these, without affecting the burner or mantle, and giving the excellent candle powers named, is good testimony. The burner, in several designs, has been seen at the office of Messrs. Bland and Co., of Ormond House, No. 63, Queen Victoria Street, E.C.; this firm having acquired the sole selling rights for the United Kingdom. The lamps inspected had only just been fixed, and everything was fresh and suitable for obtaining the best results. Under these conditions, the mantles were of a white incandescence throughout, and so were giving a brilliant light; and Mr. Bland assured the writer that this condition was the one he still experienced after two months' personal trial of the lamps.

THE "BLAND" BURNER.

There is nothing particularly new in the construction of the burner; but our informant mentioned that endless experiments had been made to get the whole combination as scientifically accurate as possible. An examination of the lamp shows that the air enters vertically at the top; and its regulation is accomplished by an easily adjusted shutter. The gas-nipple has only a single hole of oblong shape; but inside there is a fine piece of gauze. At the end of the bunsen tube, the nozzle is of magnesia, and simply screws on. Another point is that, instead of the mantle being supported in the ordinary way at the end of the bunsen tube, a small elongated bulb (which, attached to a brass rim, is fitted into the burner-head by means of a bayonet joint) is formed internally with a shoulder, and upon this the supporting frame of the mantle rests. This no doubt has a very material effect upon the life of the mantles, seeing that, no matter what amount of jarring the burner itself is subjected to, the mantle is quite independent—the nozzle of the burner merely protrudes inside the mantle, and is unattached to it. In other forms a brass support is slipped into the globe to carry the mantle. A shell-shaped deflector above diverts the products of combustion away from the air inlets and chamber of the burner.

The construction generally and the small bulb-shaped glass lend themselves to some excellent combinations for decorative effect. Either small or large shades, globes of various patterns, or beaded screens can be used; and, going away from the purely domestic patterns, there are those for business premises, and a simple form with enamelled reflector, for factory lighting. Burners with bye-passes and others of the bijou type are the directions in which there will be productions in the near future.

North British Association of Gas Managers.—We have received the report of the proceedings at the 44th annual meeting of the Association, held in St. Andrew's last July, under the presidency of Mr. James Carmichael, of Barrhead. It is, as usual, accompanied by the "Statistical Report of the Gas Supply of Scotland," by the Committee of the Association; the figures given being for the year ending the 1st of August. The pamphlet has been produced under the supervision of the Secretary, Mr. R. S. Carlow.

METHODS OF CHARGING FOR GAS.

Further Remarks on Mr. A. E. Forstall's Paper.

In the "JOURNAL" for the 26th ult. (p. 894), we gave some of the remarks made upon the paper on the subject of charging for gas, read by Mr. A. E. Forstall, of New York, at the annual meeting of the American Gaslight Association, and given in the issue for the 21st of November. The portion the discussion reported was that which took place before the midday interval. We now give the conclusion, with the reply of Mr. Forstall, from whom a letter, dealing with Mr. Newbigging's criticisms at the Manchester meeting, appeared last week.

Mr. H. L. DOHERTY (New York) said he thought the question of equitable charging for gas was a feature which would limit the eventual sales of gas more than any engineering feature could possibly do. Mr. Forstall had referred to two papers formerly read, one by Mr. Clark and one by himself, both of which really were papers advocating a consumer charge, in that they advised that the expense of collection should be at least partially borne by a fixed charge, and not divided over the quantity of gas sold. A few months previously, when at his mother's home in Columbus, he found she used natural gas in one part of the house and coal gas in another. Asking her to explain why she did not use natural gas only, her reply was that she could not get the natural gas on cold days, and so used the coal gas as a matter of convenience. Becoming interested in the matter, he hunted up her bills, and found she was using about 50,000 feet of gas a year, paying $10 for it. The entire fuel bills amounted to something like $80 a year; and assuming that this figure was right, and also that the expense of collection amounted to $4 per annum, it meant that 40 per cent. of all the money she paid the natural gas company represented collection expenses; leaving only 60 per cent. to cover gas and the other charges. Had she used gas for all her heating, lighting, and cooking, the collection expense would have been only $4 on the $80 a year, or about 5 per cent., instead of 40 per cent. If they increased the sales of gas in the case of all their present consumers without raising the maximum demand, they would only have to pay money for raw materials and the labour directly proportional to such raw materials. Taxes, interest, and other expenses, if advanced, would be so only very slightly. With the ordinary gas company, fully 70 per cent. of the disbursements would be expenses other than for output. The paper referred to by Mr. Forstall, where a collection charge of $2·50 per annum was arranged, would mean not more than 7 per cent. of the entire receipts. The arrangement that Mr. Forstall proposed would provide for only a small percentage of the receipts in the form of a fixed charge; and therefore he (Mr. Doherty) saw no reason why the fixed charge should not be based on every expense that did not directly increase or diminish the output expenses. There was another thing. They could not apply this system of charging to those customers who would be adversely affected by it, which meant that they could not give the profitable consumers all the benefits to which they would be technically entitled under this system of charging, or at least the benefit could not be given until they further developed their market. If they charged one set of consumers on the 1000 cubic feet basis, and allowed all unprofitable consumers to remain on the other basis, some one must settle the expense these consumers occasioned. Therefore he saw no other way of applying this method of charging than putting in an optional rate which did not seriously affect the gross revenue or the net earnings, and, as rapidly as they could develop business, having the method of charging continued, and making reductions to apply by gradations to the profitable consumers. They knew that the tendency in the matter of charging by a *quasi*-public corporation was downwards, perhaps more so by gas companies than by any other. If they could confine their future reductions to profitable consumers, and in this way open up fresh fields for the development of new business, they could eventually be able to sell gas at a lower rate to all. They now had many consumers who used their service as a matter of convenience; and he could never see why these should be carried on the system at a loss. But assuming that they must be so carried on, it seemed to him illogical to give them further concessions. When they were selling gas for $1 per 1000 cubic feet, they were charging about $1·50 per million British thermal units, and there were few towns where fuel could not be bought in the form of coal at from 15 c. to 20 c. per million units. The only hope of successful competition of gas with coal was to have the appliances of such efficiency that the great difference was made up. If they attempted to carry an investment big enough to take care of the peak of some particular consumer who might demand gas at the high rate for one hour out of 8760 hours in the year, it meant that they would never be able to sell gas at a cost approaching the value of solid fuel. Mr. Forstall not only wanted to take average results, but those at the point of outlet of the peak of the holder. This he thought was manifestly unfair. Ordinarily they supplied the consumer with a 5-light meter, which, if used continuously, would pass a million cubic feet of gas per annum. The consumption of the individual consumer varied from nothing at all to (say) 500,000 cubic feet a year—averaging about 30,000 cubic feet. The small user who consumed 30,000 cubic feet must have a meter that was capable of passing 1,000,000 cubic feet a year; and thus the load-factor on the plant was correspondingly increased. Mr. Forstall indicated by his statement that the average sales of gas were one-fifth of the maximum; in other words, that the average gas plant on the main transmission lines had a load-factor of about 20 per cent. This meant that 20 per cent. of the gas was sold that the main transmission system was capable of carrying. When it came to a given section of distributing main, they had a much lower load-factor than that indicated by Mr. Forstall; and it was only when they got on the main transmission line, where all consumers were averaged, that they had the load-factor treated of in the paper. Some of the speakers had referred to this method of charging as an experiment; but it was not one. It had been used for upwards of three or four years in the distribution of electricity by some of the companies with whom he (Mr. Doherty) was connected. Personally, he was not urging the adoption of the system, as it was a matter of indifference indifference to him whether anyone adopted it or not. Where it had been applied in the electrical department of his companies, it had removed nearly all complaints. Where it had been applied optionally, and not forced upon the consumers who would be affected unfavourably by it, it caused the greatest possible increase of consumption for a given investment. In Denver, it had built up the consumption of current per lamp connected from 16 to 43 kilowatts per annum, or, at all events, while this system of charging had been in vogue the consumption per lamp connected had been increased according to the figures stated. Last year they started to apply the rate on a certain portion of the gas consumers, believing they could so develop the business and increase the net earnings that they could make further cuts, until they reached practically all the other consumers. The first were put on this method in March last, and they had increased their consumption more than 40 per cent. The Company were now in a position to make another cut, and develop their business still further. For the most successful application of the system, he believed that the fixed charges should be very high. The lower the cost for gas, the more freely would it be used, and the more effort would the consumer make to use it, so long as he did not increase his maximum demand.

Mr. J. W. DUNBAR (New Albany) asked Mr. Doherty if, in the application of his rates, he met with any resistance in the way of legislative enactments; and, if he had, how he overcame them. In Indiana, gas companies were prohibited from charging a consumer for more or less than the register of the meter showed.

Mr. DOHERTY replied that he was not a lawyer, but it seemed to him that any such law, carried to its ultimate conclusion, would virtually result in a confiscation of property. If he were in Mr. Dunbar's place, he would not hesitate to limit the consumers' demand so that they would have to use the gas one-third of the number of hours in the year. If then they wanted the service on this basis, they could have it; otherwise he would insist on them paying a proper return on the expense occasioned.

Mr. D. M'DONALD (Louisville) said that, for the benefit of those who contemplated putting in force any such thing as a meter-rent or other similar charge, under whatever name they called it, the Courts held that it was legal and proper to levy a higher rate per unit for a small than for a large consumption. In other words, they could charge a man for 100 cubic feet of gas a higher rate than they would charge the one who used 1000 cubic feet. The Courts had upheld this sort of discrimination.

Mr. DUNBAR asked Mr. M'Donald to explain the matter a little further, as almost all gas companies had a limit in regard to the amount they might charge. His Company charged as the limit $1 per 1000 cubic feet; but what he would like to know was whether the Courts would uphold them in charging $1 for 100 cubic feet.

Mr. M'DONALD replied that they would not, if one were under contract with the public to furnish gas for 10 c. In the absence of any franchise retrictions, the Courts would uphold the general principle of refusing to furnish customers at a loss.

Mr. FORSTALL then replied to the various speakers. He said that, as he understood it, the chief difference between Mr. Frueauff and himself was that he (the speaker) did not include any profit in the fixed charges, while Mr. Frueauff did. His point of view was that a gas company were in business to sell gas at a profit. Incidental to selling gas they found it necessary to supply a certain amount of equipment, in order that consumers might be able to use the gas. If they got back only the interest and depreciation, with the cost of maintaining this equipment, that was all they could expect to do. They sold gas-stoves, and placed house-piping, &c., simply because they had to do so to develop their main business; and therefore, to his mind, the profit should not be made on the incidentals but on the gas sold. It was necessary to keep from not making any profit on some of the consumers that they charged them the cost of furnishing the installation and maintaining it, but for nothing further. Another objection of Mr. Frueauff was that he (Mr. Forstall) did not, in the maximum-demand charge, take care of the fixed charges for consumers, &c., at the works. He thought it was very hard to connect these consumers with the maximum demand; and it seemed they would vary more with the ideas of the managers of the company than they would with the difference between maximum or even average demand. They had no right to charge such matters against a maximum-demand charge. Mr. Dawes seemed to make the mistake made by practically everybody who had stood up for a uniform price of gas per 1000 cubic feet. He

confused the small consumer with the poor man. The small consumer who caused them the most loss under the uniform-method price of charging was not the poor man, for the latter used gas quite liberally, and in most cases would only be slightly affected by the proposed change. The smallest and the most unprofitable consumers they had were the offices and houses of comparatively rich men, who maintained a gas-meter simply for the sake of turning on the gas in case the electric light went out. The idea that if they put such a method of charging into effect would result in antagonizing the poor people seemed to him an entirely mistaken one. So far as making a differential charge was concerned, which Mr. Dawes seemed to be afraid of, he did not know of a single company who did not make differential charges. In order to avoid unduly increasing the charge to the poor consumer, it would be necessary to make the change at a time when the reduction in rates was being effected. In this way it could be made so that the poor consumer would pay practically no more than he had been paying before. Mr. Doty seemed to think he (Mr. Forstall) was trying to take care of the business on an investment of 37·5 c. on a certain amount of annual sales; but he overlooked the fact that the amount of investment included in the maximum-demand or consumers' charge was not the total, but merely the investment necessitated by the maximum-demand over what would be wanted if the demand were an average one, and also that it was only the excess of the investment needed over what would be put in in any case, no matter how small was the demand. Mr. van Ness made the point that if they carried into effect any such method of charging, they would discourage the business promoter. He (Mr. Forstall) thought the new business promoters of gas companies should be discouraged in going after certain lines of business; and if they were discouraged on those lines, their time could be much more profitably occupied than it was at present in getting consumers along profitable lines. Consequently, this argument did not appeal to him at all. He hoped that it would discourage the new business promoter on certain lines along which he often worked. He differed from Mr. Doherty as to not being able to apply this rate to all consumers. He thought in course of time they could apply it to all; and his object was to show how this could be done in course of time. If they did not see what they were working for, they might never reach their object. If they allowed the present expediency to cover up the ultimate end, the end was apt to remain buried. He agreed with Mr. Doherty that the future reductions should be made to profitable consumers, and that in cases where companies changed gradually from the present method of charging to that advocated in the paper, it should be made so that, if possible, the charge to small consumers should stay about as it was, and that all the reduction should go to the large consumers. So far as the charge for the maximum demand of each consumer was concerned, he maintained the position that the only charge they could make was for the actual investment; and he did not see how one could prove that any such investment had been made when the average came out much smaller than the figure provided for as the average maximum demand as worked out. But in providing this maximum the question of equitable investment was also covered by the point made in the paper, that they would have to supply a man with some service-pipe and some meter, and that they could not supply him with a meter smaller than a 5-light at less cost; the only additional investment in supplying the meter being the extra cost over a 3-light meter. In practical operation, no one would put in less than a ¾-inch service-pipe, no matter whether the consumer used 1 foot or 100 feet of gas per hour; so that the excess investment in that case was only the extra cost over the ¾-inch pipe. Mr. Dunbar's point came out in the case of the New Orleans Gaslight Company against the Harmony Club. The latter was using electric light exclusively; and as the electric service was erratic in New Orleans, the light was apt to remain out frequently for an hour. The Club demanded from the Gas Company a meter large enough to supply gas to light the whole club-house; and they used it possibly two or three times a year. The Company grew tired of this, and insisted that the Club should either pay for a certain quantity of gas per month for the use of the meter, or accept one which would pass, on an average over the year, the gas used. The Club obtained an injunction against the Company, preventing them from taking out the meter. The case was carried to the Supreme Court of the United States, where it was finally decided that the Club had no inherent right to use the Company's property for their own convenience, and that if they wanted a large meter they would have to pay for it. So far as the franchise enactments were concerned, many companies were in the position that they could not do anything but charge the consumer a flat-rate. What they had to do was to get such franchises changed. As to not being allowed more than a certain amount of excess, he made the point that the method did not charge any more. He thought it could be shown that they were not charging for excess, but simply for the service equipment they had to give a consumer, whether he used gas or not, which he should be willing to, and which they should be in a position to make him, pay for. He thought this point was clearly brought out, by way of sustaining the position of the Company in making such a charge. Mr. Lathrop seemed to think that 4 per cent. was not enough for the depreciation of gas property. If 4 per cent. of the value of their plant was invested yearly at 5 per cent. interest, and they figured this on the cost of the plant, they could replace all in 16 years. He did not know of any gas-works which had been replaced in this period; and, besides, there was a great deal about a gas plant which did not depreciate, because it was taken care of by maintenance. The retort-settings were renewed every three years; and the charge all went to maintenance and repairs. There was no depreciation on meters, as this also was charged to repairs. He should like to get someone who would renew a gas-works every 16 years. The 25 c. charge at Mauch Chunk (Pa.) was probably too small. It was the first step in the direction of putting in the compulsory charge; and he wanted to get the thing started. He thought when they got into a position to lower the price of gas, they would increase the fixed charge, so that the smaller consumers would pay about the same, and the larger consumers would get a greater reduction.

THE MIDLAND JUNIOR GAS ENGINEERING ASSOCIATION.

Last Saturday, a meeting of the Association was held in Birmingham, under the presidency of Mr. F. J. Bywater. The business consisted of the reading of a paper (an abstract of which, together with a summary of the discussion, appears below) by Mr. S. T. Smith, of Walsall, entitled

SOME TYPES OF STOKING MACHINERY FOR HORIZONTAL RETORTS.

The author said the chief considerations in adopting machinery for the drawing and charging of horizontal retorts were: Economy in working, efficiency in the work performed, and the rapidity with which the retorts were drawn and charged. In small works, where the make of gas per day in the summer-time did not warrant power machinery, manual machines might be advisedly adopted; for though the difference in the number of men required to do the work was not so great, yet the retorts were drawn and charged with greater ease, with greater rapidity, and more uniformly than by hand—resulting in better charges, better heats, increased yield of gas per mouthpiece, and better coke. In larger works, where the minimum make of gas necessitated a greater number of beds working, there appeared to be no question but that it paid to instal power machinery; for with its aid fewer men were required (and this meant in a large works in the winter months an enormous reduction), the work was performed in a shorter time, the retorts were not open—and consequently not idle—for anything like the length of time as with hand work, and the charges were more uniformly distributed in the retort. This latter point was one which not only affected the yield of gas per mouthpiece and per ton, but also the heat of the retorts, as the retorts could be maintained at a more uniform heat, thereby obtaining more thorough carbonization, and enabling one to either carbonize in shorter periods or, by increasing the weight of coal per retort over the same period, obtain a greater yield of gas per bed per twenty-four hours.

Two types of machines—the West and the Arrol-Foulis—stood out prominently as the successful pioneers of stoking machines; and these held sway for a long time, until inclined retorts were successfully introduced, when a great struggle for supremacy between horizontal retorts with stoking machines and inclines began, and was still going on. But with this struggle inventors turned their attention to improve the method of charging horizontal retorts by machinery, and at the same time to reduce the cost of the machines and of their working; and, as a result, they had the application of centrifugal force, as evidenced in the modern charging machines first practically applied by M. de Brouwer, at the Bruges Gas-Works, with his projector, and at Paris with the electric turbine charging machine. By the aid of these inventions and others more recently brought out, 20 feet horizontal retorts could be charged from one side of the retort-house—necessitating only one machine, and reducing the cost of working to one-half in comparison with the earlier types of machines.

Stoking machines might be divided into two classes—charging and drawing machines. These, again, could be divided—the charging machines into those that placed the coal in the retort by a portion of the machine entering the retort, and those that projected the charge into the retort; and the drawing machines into drawers and pushers. Then the motive power was varied; some machines being driven by compressed air, some by ropes, some by hydraulic power, while the more modern inventions were worked by electricity. Steam was tried; but it had so many disadvantages that it was soon discarded for other methods.

When considering the type of machine to be adopted, one had to decide upon the motive power by which the machines were to be worked.

Compressed Air.—This was generally associated with the machines made by the West Gas Improvement Company. They obtained their power by means of an air-compressor worked by a steam-engine, which compressed the air to the required pressure in two stages. The compressor consisted of two cylinders—one a low-pressure and the other the high or final pressure cylinder. The air was drawn into the low-pressure cylinder, compressed, and then cooled down. It was then drawn into the high-pressure cylinder and compressed to its final stage, which at Walsall was 67 lbs. to the square inch. The air then travelled to a receiver,

where it was stored, and from which the supply to the machines was taken.

Rope Driving.—Two kinds of rope were used for this power—either steel wire ropes or cotton ropes. But the former were generally employed. An endless rope ran overhead along the whole length of the retort-house parallel to the bench. An engine placed in or near the gable end of the house drove (by belting) a countershaft, to which was keyed a rope driving-pulley round which the rope was wound. At the opposite end to the driving end was the tension gear for keeping the rope sufficiently taut. The bottom line of rope was used for driving, and this was wound once round a grooved wheel keyed to a shaft on the machines. One rope served two machines.

Hydraulic Power.—In this case the pressure was obtained by means of pumps, driven by an engine forcing the water into an accumulator; and from this accumulator the water was conveyed along the retort-house by means of specially-tested steel tube, having branches and stand-pipes fixed at intervals along its length. To these stand-pipes the machines were connected by means of flexible hose-pipe. Hydraulic power was used chiefly with the Arrol-Foulis machines; and these required a pressure of from 350 to 400 lbs. to the square inch. With the drawing machine a portion of the waste water was used for cooling the rake-head; the remainder being generally employed for quenching the coke, The question of water supply was one of the chief considerations with this method of power transmission; for if it had to be paid for, it would add greatly to the cost of working the machines. From 100 to 130 gallons of water were required per ton of coal carbonized.

Electricity.—As a motive power for stoking machines electricity had come to the front recently in a remarkable manner. The current might be obtained from a local supply, if the price were reasonable, or from a dynamo erected on the works and driven by a gas-engine—the latter method being the better, as one was then entirely independent of outside failure. The current was taken into the retort-house by insulated cables. Bare copper wires were run overhead the whole length of the retort-house; and from these wires the current was transmitted to the motors on the machine by means of a trolley-arm fixed to the framing of the machines.

Having thus briefly explained the various kinds of motive power used with stoking machinery, the author turned his attention to the different types of machines in use. He remarked that, as already stated, charging machines might be divided into two classes—those in which some portion of the machine entered the retort and placed the coal in position, and those which threw or projected the coal into the retort without any portion of the machinery coming into contact with the retort. The chief machines of the former type were the West, the Arrol-Foulis, and the Fiddes-Aldridge; and of the latter, the De Brouwer, the Toogood, and the French turbine charging machine—the latter having, he believed, up to the present proved a failure in this country. He then described at length the machines named, all of which have, of course, on various occasions been referred to and illustrated in our pages. An illustration and some particulars of the De Brouwer projector at Walsall appeared in the "JOURNAL" for Oct. 27, 1903 (pp. 215-6).

Coming to drawing machines, these, Mr. Smith said, could be divided into two classes—(*a*) those where the rake entered the retort and on its return drew the coke out, and (*b*) those in which the rake pushed the coke out of the retort at its opposite end. From this, it would be seen that the latter (or pusher) type could only be used where through retorts were in operation, and then only one machine was required where two of the former type (or drawers) would be necessary. Of the drawer type, West's was most generally known and used. Of the pusher type, there had recently been several inventions; but when one looked into each separately, it was found that the main points were the same, and that the difference was generally in details which the inventor found from his practical knowledge and own observations to be more suitable to his requirements. To his mind, the pushers were certainly a great improvement on the drawing machines, as one only was required for a bench of 20 feet retorts, and this was generally working on the non-firing side of the bench, so that the coke coming out of the firing side could be directed into the furnace, and the machine was not subjected to such a heat as those which had to stand in front of a furnace while it was being fired. One machine only being required, the capital outlay was reduced; and there was also the wear and tear of one machine, as against two of the other type.

The author then described the West compressed-air drawing machine as in use at the Walsall Gas-Works, the Jenkins-De Brouwer pusher, and Dempster's discharging machine.

As regarded working costs and wear and tear of the two types of machine in use at Walsall, he submitted a few figures, but said they could not be taken for comparison, as in the case of No. 1 retort-house, with West's machines, all the work was done by machine from the time the coal was brought into the house to the loading up of the coke into boats or the stacking of it, whereas in No. 2 retort-house, with the De Brouwer charger, they still drew the retorts by hand, and wheeled the coke out on to the wharf in barrows.

No. 1 Retort-House, West's Stoking Machines.—This house contains 14 beds of 8 retorts per bed, 22 in. by 16 in. by 20 ft. long, with stop in centre, working 4 hrs. 48 min. charges and 6 cwt. coal per retort.

Taking the total cost of repairs and working for the four years the machines have been at work, and dividing by the coal carbonized during this period, 154,554 tons, the following is the result:—

	Per Ton of Coal Carbonized. d.
Cost of repairs, which includes all material and labour	0·875
Cost of running machinery, including air compressor, two gas-engines, and two coal handling plants	1·08
Bringing the total cost of working the machines to	1·955

	Per Ton of Coal Carbonized. s. d.	s. d.
The cost of carbonizing in this house is	1 9·75	
Add the cost of working and repairs to machinery	1·955	
And also cost of repairs to coke conveyor and working it	3·656	
Giving total carbonizing cost		2 3·361
If this house was worked by hand and 6-hour charges, the cost would be	2 8·84	
To this would have to be added the cost of either stacking coke or loading coke up into boats	6·00	
Giving total carbonizing cost		3 2·24

So that there is a clear saving due to machinery of 10·879d. per ton of coal carbonized, *plus* an additional 2 tons 10 cwt. of coal carbonized per bed per 24 hours.

No. 2 Retort-House, De Brouwer Charger.—In this retort-house there are 20 beds of 8 through retorts per bed, 20 in. by 16 in. by 20 ft. long, carbonizing 6 cwt. with 6-hour charges.

	Per Ton of Coal Carbonized. d.
The cost for repairs to machinery for six months, January to June, 1905, during which time 11,108 tons of coal have been carbonized	0·41
The cost of running the machine, including dynamo, 2 gas-engines, and coal handling plant	1·72
Bringing the total cost of working the machine to.	2·13

	Per Ton of Coal Carbonized. s. d.	s. d.
The cost of carbonizing with this machine for 10 beds using 96 tons per day	2 0·20	
Add to this the cost of working and repairs.	2·13	
	2 2·33	
Plus cost of coke handling	6·00	
		2 8·33
Whereas the cost for hand charging on the same number of beds is	2 8·15	
Plus cost of coke handling	6·00	
		3 2·15

Showing a saving of 5 82d. through the machine.

Discussion.

Mr. F. W. STEVENSON (Coventry), who received a cordial welcome to the meeting from the President, said he wished the Association every success; and he felt sure that if they proceeded as they had begun, this success would be secured. The matter, of course, rested entirely with the members themselves. There was not one who was too young or in too junior a position on a works to notice some small thing that would be worth bringing before the Association. A very little matter was often instructive, and led to a good discussion. This was, of course, the chief object of the Association—that the members should, by a free exchange of views, increase their knowledge. With regard to the paper, he would congratulate Mr. Smith very much. He had given a clear description of the various classes of stoking machinery. His (Mr. Stevenson's) experience had been entirely with the West machines. At Sheffield, the wire rope gave them so much trouble that they changed it to a cotton rope. This ran a season, and he believed it would have gone longer; but they altered it then. He knew that at some places wire rope had been found very successful; and he thought a case in point was East Greenwich, where the wire rope on the West machines was extensively used. Mr. Tysoe had done a lot of work and obtained most excellent results with the West machine. This showed that wire rope would do as well as any other under certain conditions. Later, at Sheffield, they put in West's compressed air machinery; and that certainly did extremely well. He must say, however, that he found the cost of the upkeep of the machines heavier than Mr. Smith had stated. He did not know why it should be so. Each set of machines ran from eight to nine months in the year, and dealt with from 20,000 to 30,000 tons of coal. Still the cost of upkeep never worked out at less than 2d. per ton, and sometimes it was as high as 3d. Of course, the one that needed most repair was the charging machine. The gear-wheels would wear out. At the time these machines were put in, nothing had been thought of the projector; and he had no doubt that if anyone had then proposed to push the coke, he would have been scoffed at. When first he heard that M. de Brouwer had brought out a pusher, he remembered a retort maker saying to him: "That will be a good thing for us." He, however, thought that the pusher had come to stay. He was not long ago at the Rotherhithe Works, where a hydraulic pusher called the "Co-Partner" was used; and there,

with a make of about five millions, he was told they had not a rake on the ground. The retorts were beautifully discharged; but it was only fair to say that they were almost new. He had, however, since then seen the De Brouwer arrangement working on retorts that had been in use for about a thousand days; and this was a very severe test. He thought that it spoke volumes in praise of the De Brouwer plant that retorts of this age—all with the exception of two—could be discharged by a pusher. No doubt if it had been known earlier that the De Brouwer pusher was to be put into the house, the retorts which were in a bad condition would have been re-set. He was particularly interested in the subject dealt with by the paper, because they were building new works at Coventry, and naturally he wished to secure the best machinery. It seemed to him that, though the old type of scoop machine laid the truest and best charges, yet the advantages were certainly in favour of the projector; and so far as he had at present gone—he had not absolutely come to a decision—he was inclined to put into his new retort-house a projector or discharger of the De Brouwer or other type. He had not yet had an opportunity of seeing the Fiddes-Aldridge machine; but he understood it was working very successfully at Liverpool—so successfully that the Engineer contemplated putting in another installation. It seemed to be getting very near the point of perfection when one could put the coal in and push the coke out at the same time. Some little trouble might occur when the furnaces were being fed, for then the pusher must work very slowly indeed; and with the coal being laid at the same time that the pushing was going on, this might be rather a difficulty. This appeared to him to be the chief drawback. He was glad that nothing had been said about inclined retorts. He was strongly of opinion that the improvements that had taken place in machinery for horizontal retorts gave them the advantage; and he was thankful to say he had never put up any inclines.

Mr. A. H. Redfern (Windsor Street) thought the charging-machine was the principal thing on the gas-works. If there were not good chargers, there naturally would not be good heats; and if there were not good heats, there would very soon be leaky retorts and stopped pipes. Of the types of machinery Mr. Smith had referred to, there were two that struck him as being the most likely to be discussed. It had always seemed to him that the De Brouwer machine had one or two very great advantages; but the coal had to be of absolutely even size. Supposing the charging was going on all right for a time, with only small cobbles going in, and then a piece of coal (say) six inches square came along, this would momentarily block the passage-way, and cause a loss of speed which would make the coal fall short of the part of the retort where it was wanted. This was a point which should certainly be got over. Then, again, there was such a thing as dampness of the coal. He had had very little experience himself; but he believed that not nearly the same velocity would be attained with damp coal as with dry. The result was that it had to be left to the man in charge to regulate the speed of the drum. With regard to the use of rubber belts, might not these be seriously affected by the heat of the retort-house? He preferred the Toogood machine to the De Brouwer. The latter ran at 800 revolutions per minute; whereas the former ran at only something like 80 revolutions. In the Toogood machine, the blades when they received the coal were travelling at a rate of about 400 feet per minute; but by the time they had gone round and were at the point of discharging the coal, the speed was 2000 feet, or five times as great. This gave the coal a chance of going into the projector slowly, and thus it was less likely to get broken up to dust. Also with the Toogood machine he believed it was not necessary for the coal to be broken up to such a uniform size—dust could go with coal that was six inches cube, or big cobbles and dust or small cobbles and dust would go equally well together.

Mr. G. W. G. Tatam (Saltley) said that there were one or two points on which he would like information. The first was as to the relative speed of charging the retorts—from the opening to the shutting of them—in the case of the West and De Brouwer machines. Mr. Redfern had spoken about the material used for belts. He (Mr. Tatam) was down South a short time ago seeing a De Brouwer machine working; and on inquiring as to the best belt, he was informed that a cotton base with rubber over it was undoubtedly the most suitable. Strange to say, the rubber substitutes were not as efficient for the purpose as pure rubber. He did not know why this was the case; but probably it was due to the fact that pure rubber had better stretching qualities, and gave to the heat; whereas the substitutes tended to crack. Mr. Smith described the De Brouwer as a centrifugal machine; but he (Mr. Tatam) thought it was not really a centrifugal machine, because the range of travel of the coal was on a perfectly flat surface, and not in a circular direction. The velocity was given more by its horizontal travel than by its circular travel. However, this was, of course, merely a quibble. As to the Toogood machine, he rather agreed that it was inferior to the De Brouwer. With the latter all the moving parts were closed in by sheet metal work; whereas in the case of the Toogood the working parts were in contact with the coal and coal dust. Take the central cylinder. The blades worked through slots; and when coal went into the machine, it must drop on to these revolving parts, and consequently give them a tremendous amount of work. Blades thus got loose; and this, he thought, affected somewhat the efficiency of the machine. Then, again, it seemed that there was a chance of the machine getting blocked, as it was quite possible for pieces of coal to get wedged and bend the blades to some extent; but it was, of course, true that with careful crushing of the coal, this difficulty would be got over. He would like to suggest that such a paper as they had heard that day would be very much better if accompanied by diagrams or lantern slides. This would greatly aid the members in understanding the plant described. Of course, juniors had not the time to prepare elaborate sketches; but illustrations, even if on very small lines, would be of assistance.

Mr. A. N. Comely (Windsor Street) thought that there was one point with regard to the De Brouwer projector which it would be well to bring forward—that was, the simplicity of the machine. Anyone carefully going over the construction of a West and a De Brouwer charger could not fail to be struck by the simplicity of the latter. A machine should be first of all simple; and if only they could have a discharging machine as simple in its principle and details as the De Brouwer projector, they would be a long way towards the consummation of the charging and discharging of horizontal retorts in the very best way. At Walsall they had found that they could work with a shorter length of charges in the case of the West machine than with the De Brouwer. Speaking theoretically, he should think it would be easier to work four-hour charges with the scoop machine than with the projector. As to the Fiddes-Aldridge machine, he thought the wear and tear of such an elaborate arrangement would be rather heavy; but, of course, it was early to speak of that. With regard to the pusher, it had been suggested that the use of tapered retorts would be an advantage.

Mr. A. O. Jones (West Bromwich) remarked that everywhere the De Brouwer was supposed to be a much simpler machine, and consequently should cost less for upkeep; but according to Mr. Smith's figures, the repairs for the De Brouwer were 2·13d. per ton, as against 1·95d. for the West machine. It seemed it should have been rather the other way about. The chief thing was the cost per ton of coal carbonized; and in that case Mr. Smith's figures showed that the West machine was the more economical—although the figure of 1s. 9¾d. per ton of coal carbonized seemed rather high for power machinery. They had manual machinery in use at West Bromwich; and they did their carbonizing at 1s. 8d. per ton, the repairs to the machinery working out at about ½d. per ton. It would be interesting to know what amount of coal was handled per shift per man under the different systems.

Mr. J. H. Willoughby (Leamington) asked how they got on with regard to patching the retorts, and whether the retorts lost their shape when the machinery was used.

The President, in proposing a vote of thanks to Mr. Smith, said the question of stoking machinery was a very big one; but he thought they were now all agreed that there was no doubt at all about its efficiency and economy. There was only one gas engineer of repute in the country who did not believe in stoking machinery; and he certainly backed his opinion by very good figures. No doubt, stoking machinery did reduce the cost of gas manufacture very considerably; and he thought that, as pioneers, the names of Mr. West and Mr. Foulis were worthy of all honour, He always understood that steam was a failure, until he saw an old Ross rake in operation. There was no doubt that this worked very well; but he did not know what had become of the charger. He agreed that the De Brouwer projector was a nice, simple-looking machine; but he thought Mr. Smith's figures would not justify them altogether in taking it without careful examination. As Mr. Jones had just remarked, the costs were considerably higher per ton of coal with the De Brouwer than with the West machine; and, of course, everything was a question of £ s. d. in a gas-works. He did not wish to introduce the subject of inclined retorts; but their costs at Birmingham were certainly considerably lower than these, and they had inclined retorts. The compressed air machinery at Birmingham did splendidly; and the repairs were not, he thought, so high as the figure mentioned by Mr. Stevenson. The machines were very economical; and they did their work most efficiently. The question of a rake or pusher was an interesting one. The pushers so far had mostly been worked on new retorts; but it occurred to him that if they were put on to retorts that had had a lot of use, the coke would have a tendency to crinkle, and so damage the retort. He could not see any difficulty in the coal travelling at a greater speed in the De Brouwer than it did in the Toogood machine. Wet coal undoubtedly caused trouble with the De Brouwer charger; and so it did with inclined retorts. It always had to be met; and there the personal element entered in. There must be an intelligent man to adjust matters. For instance, with inclined retorts the man had to restrain his charge or put it in quicker, according to its condition. There must be the personal element, though certainly it did not enter much into West's scoop machine. As to telescopic dischargers, he did not know whether any satisfactory packing had yet been found for the glands.

Mr. A. W. Smith (Saltley) seconded the vote; and it was heartily carried.

Mr. Smith, after acknowledging the vote of thanks, said he was agreeably surprised at the length of the discussion to which his paper had given rise. Mr. Stevenson had raised a question about the cost of working West compressed-air machines. Those at Walsall were installed in October, 1901; and they worked continuously, without stoppage (except for, generally, eight hours a

week), until about March 20 last. He thought this was a very good record for any machine. Then they commenced again on June 30; and his figures were up to the end of last year—Dec. 31. They were composed as follows: 1902 (fourteen months): Tons of coal carbonized, 39,833. The repairs came out at 0·54d. per ton. 1903: Tons of coal carbonized, 42,861; and the cost of repairs, 0·94d. 1904: Tons of coal carbonized, 41,340; and the cost of repairs, 0·27d. This was owing to certain alterations having been made which they had been experimenting with during the year before. 1905: Tons of coal carbonized, 30,520; and the cost of repairs (the machines were shut off and thoroughly overhauled) was 1·75d. The average cost of repairs over the four years was thus 0·875d. per ton of coal carbonized. The cost of running the machinery included the oil and the gas for the gas-engines; and the total cost of the working and repairs came out at an average of 1·955d. per ton over the four years. A most careful record was kept on the works regarding the cost of all repairs to the West, the De Brouwer, and the other machinery. The labour and material bought was all booked separately; and stock was taken at the end of every year. Thus they knew absolutely the exact cost of repairs; and these were the figures. He fully endorsed what Mr. Stevenson had said as to the excellence of the working of the De Brouwer pusher. A few days since, he (Mr. Smith) went to Derby and Nottingham, and saw the pusher at work there; and he was very much struck with it. More beautiful work he had never seen. Certainly there was a small amount of coke left in the retort which the pusher did not touch; but it was very trifling indeed. Another member had spoken about the pusher jamming. Mr. Moon, at Nottingham, told him that they had to be very careful or the pusher did jam, if the charge was light in places. With the De Brouwer machine, sometimes the man in charge reduced the speed too much, and the coal would be rather thin in the centre of the retort. Then if he determined to get the charge in, and jammed the mouthpiece up, the pusher might jam the coke. But with good charges, the pusher should be a machine that had come to stay. He preferred it to the West machine for simplicity. Regarding the Fiddes-Aldridge machine at Liverpool, he was most anxiously waiting further particulars as to this. Mr. Stevenson had raised a question about feeding the furnaces. This difficulty might perhaps be overcome by putting a hopper over the firing-door, so that the coke might drop into the hopper, and the furnace be fed that way. Mr. Redfern had referred to the need for the coal to be of equal size; but he (Mr. Smith) did not believe this was necessary. Of course, the more uniform it was, the better was the charging; but, at the same time, the machine-man knew exactly what coal he was using, and according to the coal that was in the hopper, so he could regulate the speed of the projector. It was purely a matter of speed. Mr. Redfern did not seem to like the idea of leaving these things to the machine-man; but if he had machines to look after, he would find he would have to trust the men. If there was an intelligent man at the machine, he would do what he could to secure good charges, because he had not only got an engineer, manager, or superintendent who would be at him, but there were also his mates who drew the retorts. They would soon tell him of it if he got a bad charge. As to the effect of temperature on the belting, the machine was placed 5 feet away from the retort mouthpiece; and at Walsall they had not found any difficulty in this respect. First they used a leather belt; and this wore considerably on the coal-path. Then they tried a rubber belt, which stretched too much; and afterwards a leather or cotton belt rubbered was put on, which gave very good results. Their present belt had dealt with just over 6000 tons of coal; while at Nottingham they stated that they had got up to 10,000 tons. He could not agree with Mr. Redfern that the Toogood was anyway a better machine than the De Brouwer. He did not think it had yet been installed in any works for sufficiently long to show what the repairs would come to; but there were many working parts. The figures quoted by Mr. Jones were the total cost of working the two machines. The cost of repairs, including all material and labour, in the case of the West machine was 0·875d. per ton; whereas with the De Brouwer it was 0·41d.—or only half as much. But the cost of running had brought the De Brouwer up to more, because in that case there were two gas-engines, and extra engine oil was used. If they had more work for the De Brouwer plant, the cost would not be proportionately increased, because they could operate many more retorts with the same amount of oil on the engines. This was where some of their waste was going on; but it could not be avoided, when putting down plant in excess of existing requirements. Mr. Tatam asked the time taken to charge the retorts. In the case of the West machine they were drawing and charging by machinery; but with the De Brouwer they were still drawing by hand. The actual charging, however, took from 30 to 40 seconds. The charge was calculated at 6 cwt.; but for the past year it came out at 5¾ cwt.

Mr. TATAM: The time for charging and drawing with the West machine would be practically the same as with the De Brouwer? I want the length of time the mouthpiece would be open.

Mr. SMITH: Well, of course, it depends on the drawing arrangement; the time of charging is much the same in both cases. We can comfortably do 42 retorts in an hour, including the firing of the furnaces. Continuing, he said that Mr. Comely had referred to the length of the charges at Walsall. With the West machine they worked 4 hrs. 48 min. with 6 cwt. of coal; and they worked off very well. But they were handicapped with regard to the De Brouwer, inasmuch as they were working in a house with very small ascension-pipes, hydraulic mains, and take-offs. They were therefore not trying 4 hrs. 48 min. there. As to tapered retorts, of course, that was a matter of re-setting. He should think it would be advisable to put in slightly tapered retorts with a pusher; but it was not absolutely necessary. The carbonizing costs at Walsall were certainly high; but this was also the case with hand charging. The men were so well paid that when No. 1 retort-house was reconstructed it was absolutely necessary to put down machinery. It was impossible to state the cost per 1000 cubic feet. Although they had two separate sections, in the winter months they had to bye-pass, and the gas united, so that they could not tell the amount made in each house. He could not give Mr. Jones the amount of coal handled per shift per man. A drawing machine had an effect on the shape of a retort; but the charging itself did not alter it at all. As to the use of steam, what with loss through faulty joints, &c., owing to the distance it had to be carried, it became rather costly. Then if there was a boiler, it was necessary to have a special man to attend to it. With regard to the difficulty of wet coal, this was overcome first of all by the coal being in the hoppers for a certain time, and thus getting dried. The man knew what coal he had to deal with; and he regulated the speed accordingly. Even with the West machine, the difficulty of wet coal was still present. In any case one had to leave it to the machine-man. As to the packing of the telescopic pusher, this machine had only just been erected at the first place; and thus little experience had yet been obtained.

Gas-Driven Canal Barges.

In the "JOURNAL" for the 15th of August last, reference was made to a trial of a gas-engine for propelling a 60-ton barge on the Bridgewater Canal. It was in every way successful; it being stated that a barge of the tonnage named, with two others of like weight in tow, could be driven for 50 miles at the rate of 4½ miles an hour for about half the cost of steam. It appears from an article in the "Standard," that a further trial is now being made of gas power, not on a small experimental scale, but for the ordinary work on a canal. We stated on a previous occasion that a yacht had been fitted by Messrs. Thorneycroft and Co., Limited, of Chiswick, with gas plant, which had been found to work well; and the same firm have equipped with similar plant a canal barge—the *Duchess*—which during the past few weeks has been making runs on the Thames from Chiswick to Westminster Bridge. The results were sufficiently encouraging to justify a trial under every-day working conditions—viz., with the barge fully freighted, and engaged in the carriage of merchandize. The *Duchess* was accordingly attached to the existing fleet of canal barges, and a start was made last Tuesday from Brentford for Birmingham or Wolverhampton, according to the freight. The plant with which the barge is fitted consists of a suction-gas producer and a two-cylinder engine developing 35-horse power. The heat efficiency of the complete gas plant is stated to be 23 per cent., compared with only 11 per cent. for a steam-engine; in other words, the plant consumes less than one-half the fuel that would be used in a steam-engine and boiler of the same power. A fair average consumption for different qualities of coal is 1 lb. per brake horse power per hour. The weight of the plant complete is 2¾ tons; and the floor space occupied is 7 ft. 6 in. by 3 ft. 9 in., the height of the plant being 6 feet. The running cost of the fuel is reported to be something under 0·1d. per horse-power-hour. Very considerable importance attaches to this trial, as it may result in reviving, or creating a wider interest in, our inland waterways, and re-establishing them on a basis of increased utility.

Referring to the recent elevation of Sir James Joicey, Bart., M.P., to the peerage, as noticed in the "JOURNAL" last week, the "Iron and Coal Trades Review" on Friday last made the following appreciative remarks: "During his twenty years' work in the House of Commons, Sir James Joicey has taken an active, not to say pre-eminently prominent, part in all matters affecting mine legislation, and in connection with economic and labour questions generally. As the leading coalowner in the House of Commons, he has naturally been at the head of all movements in which coalowners, as such, were specially concerned. It was a matter of surprise to many of his friends that he was not asked by the late Government to undertake the chairmanship of the Royal Coal Commission. But if he was not actually the Chairman, he inspired a good deal of the most useful work done by the Commission; and some of the evidence submitted to it by himself was of the most valuable and interesting character. Sir James Joicey's whole career has been a remarkable corroboration of the French aphorism: *La carrière est ouverte aux talens*, especially when united to great industry and reasonable ambition. As a young man, Sir James had no better start, nor, in his earlier life, greater opportunities, than fall to the lot of most; and yet he has raised himself to be the head—from a quantitative point of view, at least—of the greatest British industry; and it is doubtful whether in any country his headship, measured by the same standard, could be successfully challenged."

HIGH-PRESSURE GAS DISTRIBUTION.

Remarks on Mr. Rice's Paper.

We gave in the last number of the "JOURNAL" the appendix to the paper, on the distribution of gas at high pressure, read by Mr. H. L. Rice, of Aurora (Ill.), at the annual meeting of the American Gaslight Association. The subject evoked a good discussion, from the report of which in the "American Gaslight Journal" we make the following extracts.

Mr. J. D. SHATTUCK (Chester, Pa.), referring to the matter of steam consumption at the different pressures, on the test made in his town several years ago, said they found that a single straight-line compressor required 80 lbs. of steam per horse power, while a duplex compressor required only 20 lbs. The cost of operation was about 1¾c.; but this did not include the oil to raise the illuminating power the 0·9 candle lost in the pressure. This figure, of course, might vary. Where it did not require any extra labour, 1¾c. was a fair price. The duplex compressor would compress 1000 cubic feet of gas on 1½-horse power. Mr. Rice, the speaker noted, had said that the moisture question had been satisfactorily settled; but many would disagree with him. He did not think the solution of the electrolysis problem had been anything like reached. The North Adams (Mass.) line had insulated joints at every 500 feet; but they were still suffering from electrolysis. Two years ago they began using cement coating on the pipes, and thought they secured themselves from this trouble. It saved the life of the pipe considerably; but wherever moisture gathered between the cement and the pipe it did its work more quickly in that place, or if the cement was cracked off the destruction was more rapid. A six months' test of illuminating power as affected by compression practically confirmed the figures given to the Ohio Association of 0·9 candle—this was compression in delivery. He had been asked by several people whether the dry compressed gas reached the diaphragm. None of their meters taken out on high-pressure lines and tested showed that it did; and they did not find the meters running slower than the ordinary low-pressure meters. He thought that all high-pressure lines should be dripped, and that the drips need not necessarily be taken at the lowest point, but beyond it, in the direction in which the gas was being pumped—perhaps at an elevation of from 2 to 3 feet beyond the low point. Their diaphragm plates might catch all the water; but if they did not do so they wanted to know just where they were going to get it. About a year ago they started compressing coke-oven gas, and at the end of six months they began to compress water gas. At the time they stopped compressing the water gas they cut the line, and found that some gummy stuff previously met with had disappeared, and that the line was filled with a black powder. This, in conjunction with naphthalene, was stopped by corporation cocks, where there was considerable drop in pressure between the main and the lateral line. Their chemist told them that a simple hydrocarbon deposit was the root of the trouble. It formed with the naphthalene practically a solid ball on the lower-pressure side of the opening. It showed sometimes for a considerable distance. They overcame this by simply increasing the size of the pipe used to take off the lateral line. It meant that one could not have too great a drop in the pressure between the main and the lateral line without naphthalene troubles. He wished to emphasize this point, which was not brought out in the paper. The high-pressure system would require a great deal more attention and more inspection than was given to the low-pressure system.

Mr. G. F. GOODNOW (Waukegan, Ill.) said with regard to data as to sales of gas in thinly-populated suburban territory which would be entirely out of reach with low-pressure distribution, he had figures covering a period of two months (August and September) for districts with approximate populations shown by the last census, with an estimated increase of 20 per cent. up to the present time. They were as follows :—

Population.	Sales for Two Months. Cubic Feet.	Average per Meter Read per Month. Cubic Feet.	Miles Main.
3125 ..	4,177,300 ..	4530 ..	16
4157 ..	4,700,100 ..	3574 ..	21
1200 ..	723,500 ..	2415 ..	7

The first two districts had been in course of development for a little over four years; while in the last district the first meter was set on May 20. The actual quantity of gas sold through a 4-inch line some 13 miles long, with smaller branches extending 3 miles farther, and numerous other branches taken off all along the line, showed the working results of this method. The initial pressure was about 30 lbs. During August there were sold 5,244,000 cubic feet; and during September, 5,385,000 cubic feet. Figured on a basis of any formula given by Mr. Rice, the peak-load of this line could not be carried. It was estimated that from 20,000 to 25,000 cubic feet of gas per hour were delivered at certain periods of each day. This brought them to a consideration of the value of compression tanks near the point of consumption at the peak of the load. For such tanks were now in use at two points, two tanks about 6 miles and two tanks about 13 miles from the compressors. Each tank at 30 lbs. would deliver about 3000 cubic feet of gas; making a very material aid in maintaining pressure at distant points during the hours of greatest consumption. Their value had been demonstrated several times during the preceding few months—more particularly one Sunday afternoon, when the line between the compressors and the first pair of tanks had to be cut and some changes made. Difficulties were encountered which rendered it impossible to turn the gas on for five hours, yet the district supplied was not out of gas at the time, though the pressure dropped to about 4 lbs., which was sufficient excuse for the existence of the tanks, for such emergencies were likely to arise at any time. The tanks were tested to at least 75 lbs.; so that if advisable the pressure could be increased, which would, of course, also increase the capacity at the rate of 1500 cubic feet for each atmosphere of increase. The method of collecting condensation within 1000 feet of the compressors, by means of separators with baffle-plates, which were intended to momentarily decrease the speed of the gas and drop the moisture, had been quite successful. It was advisable, however, to furnish a drip-cock or blow-off at low points, so that in case liquid was found it could be easily disposed of.

Mr. F. S. RICHARDSON (North Adam, Mass.) said there were two or three essential points that should be emphasized. One was to get pulsation tanks at the station, separators on the line of sufficient capacity, and compression tanks at the very extreme point. These were all of them essential, as well as the regular and intelligent inspection of all the governors. As to insulating joints, the specification furnished by Mr. Shattuck provided for one joint at every 500 feet, which was on account of the very great trouble they had in North Adams. They might put in an insulating joint every 500 feet or every 20 feet; but if they ran parallel to any single trolley they would have trouble unless the pipe was run in perfectly dry soil. They had in process of elimination 95 of these joints on six miles of pipe of considerable capacity. Judging by their experience, covering two years, the safest way was to make a line running perfectly clear of all insulating joints, tapping to the rail wherever it was possible, and also to the water-pipe, and carrying by a line of ample capacity, or with a number of copper wires, the lost current from the pipe to the switchboard. The high-pressure system for gas distribution was, in his opinion, a success. If properly installed, it was simple, efficient, reliable, and economical. Apart from that, it was a great blessing to the smaller towns, for the figures shown proved it. He might tell those present that if smaller towns were within their reach, they should not delay in attaching them to their central stations. The work should be done well; and in two years' time they would be glad that it had been done—and perhaps sorry it had not been done sooner. There were many economies in every direction in the maintenance and operation of the high-pressure system at its present state of perfection. He agreed with Mr. Shattuck that the drips should not be placed always at the low points; but the pipes could be drained, and the drips could be blown by allowing the pressure to fall to (say) 2 lbs. at an hour in the day when the draught would allow it. But if the drip should be placed at an elevation of from 8 to 12 inches beyond, one would get such little condensation as would come at those points without passing the compression tank to the separators.

Mr. WALTON FORSTALL (Philadelphia) said if he were confronted with the proposition of laying a high-pressure line in any region where he thought there was danger of electrolysis, he would try to get some idea of the amount of current that was leaking into the ground. Then he would try, by taking a plain-end line, with rubber insulating couplings at every joint, to see whether, if the line were laid, there would be as much conductivity on it, and whether there was as much electricity coming on to it. If the test indicated that his line would still take electricity from the trolley company, it seemed to him that he would try to go after the company in some way. Bearing on the question of just where the high-pressure distribution ought to stop and low-pressure distribution begin, he had put down a few figures. Taking the average size of the high-pressure line as 1·5 inches, and the cost per foot laid as 17 c., it gave $900 per mile. The average size of the high-pressure main was figured on a basis of 20 to 30 lbs. compression. Taking the average size of the low-pressure main as 4 inches and the cost per foot laid as 40 c., it would give a cost of $2112 per mile. He assumed the cost of compression, including interest and depreciation on the investment, as well as the maintenance of the compressors, at 2·5 c. per 1000 cubic feet. In the cases of the high-pressure line, figuring on a mile of main, taking depreciation in every case at 5 per cent., on the high-pressure line they had $90 per year per mile. For the low-pressure line, taking interest at 5 per cent. and depreciation at 2 per cent., they had $148 a year per mile of main. For compression, he allowed 2·5 c. per 1000 cubic feet; and apparently this was not very high. From Mr. Shattuck's figures when they had a consumption of 1 million cubic feet per mile, they had to add to the high-pressure figures, for comparison with the low-pressure ones, $25; for 2 millions per mile, they had to add $50; and the $50 *plus* $90 gave $140 for high pressure as compared with $148 for low pressure. So that, when they were selling 2 millions per mile, high pressure would be more expensive than low pressure. This checked up pretty well with an investigation made from another standpoint, which showed that when they had 110 services per mile they reached the dividing-line between the high-pressure and the low-pressure system.

Mr. RICHARDSON said they had taken eight months to make a careful test all along their line, and it was a fact that no single trolley road could be operated without loss of current. It made no difference how perfectly every joint was bonded, or what the

carrying capacity of the joints might be, it was an inherent necessity that a single trolley would cause loss of current, especially in certain soils. They could get a difference of potential between the opposite points at each insulating joint; and whether they had one of these joints in 1000 feet or one every 20 feet, if the wrought-iron pipe ran parallel to a single trolley, one could always get some show of current. Along the line there might be a neutral point, where one would not get any evidence of potential; but the next day or the next week one would get twice the amount 1000 feet north, east, south, or west. They were forced to the conclusion, under the circumstances that surrounded the installation, that the only safe way to avoid the destruction of cast-iron main running 5 miles parallel to the single trolley was to do just as they were doing. He did not think there was any danger, in view of the fact that the return itself would follow the line of least resistance; but with these insulating joints maintained, and the connection made opposite the power-house to return to the switchboard, the destruction at the joint would be increased from two to ten fold, and in their case every pipe where the current left the pipe was damaged, even with the insulation. The entire pipe-lines in some circumference were found to be pitted more or less; so that it was not only upon the assumption of a theory that they adopted the method referred to. It was after eight months of careful investigation and testing that their decision was come to. As a general proposition, he thought it would be found that any pipe-line running parallel to a single trolley would always have some waste current. In answer to a question by Mr. Walton Forstall, the speaker added that his was equipped with an insulating joint at every 500 feet.

Mr. Walton Forstall said his point was that, if the wrought-iron pipe-line had been laid with an insulating joint every 18 feet, the conductivity would be so low that the amount of electricity which would escape from the track, and go on to the line and stay there, would be so small that the resulting damage would not be very material, and personally he preferred this condition to the existing one.

Mr. Richardson granted that the speaker was in a measure correct; but assuming that the insulating joint was to be put in the line at every length, from his standpoint it would be very bad construction, inasmuch as it would unnecessarily multiply the points of trouble, danger, and expense. If they put one, two, or twelve such joints in very moist earth, or earth of a peculiar character, they would at that one joint get all the current which would find a path from the rail to that part of the pipe; and in jumping from one side to the other a pitting would occur in that one joint. If they went through sand, or could entirely avoid all moist earth, where they did not have to go under water, an insulating joint at every length would reduce the trouble to a minimum; but it did not seem to him good construction.

Mr. Walton Forstall said he did not suppose they could settle the matter then, as a general proposition, because it depended on the relative conductivity of the path afforded to the current for the return to the power-house. What Mr. Richardson probably had to contend with was a poorly-built trolley line. The whole question was whether, in his case, this return path along the iron rails of a trolley with poor metallic contact was better or worse than a plain iron pipe with an insulating rubber stop-cap every 15 or 18 feet in the wrought-iron pipe. What Mr. Richardson had said about the conditions of the soil was true.

Mr. Richardson thought they all agreed that each individual case must be settled by what were found to be the local conditions. He was free to confess that the character of the soil conduced greatly to trouble from electrolysis; but, on the other hand, the system was operated by people who were not so careful as they should be. At any rate, they had been working seven months constantly rebonding the entire line, and since then they had sustained further damage.

Mr. A. E. Forstall (New York) said that for Mr. Richardson's benefit he would relate a little experience he had had with a pipe that was made with as perfect a conductor as possible, and bonded to the power-station. It was not a continuous pipe, and, therefore, was not so good a conductor as it might have been. It was a cast-iron pipe with leaded joints; but it carried enough current, whenever there was a car passing anywhere near the spot where the men were working, to send a spark three or four inches long between the ends of the service-pipe. They thought this was a very poor plant. The trolley was in the ordinary condition in regard to bonding. There was a 9-inch girder rail, with two heavy copper bonds at each joint.

Mr. Richardson remarked that the weak point in the trolley system was that a bond broken, a switch misplaced or ruptured, and not put back in proper condition, would cause great damage —perhaps unwittingly; but the fact remained that it was the case, and they had to suffer.

Mr. T. Bunker (Newark, N.J.) thought it was fair to state, on Mr. Richardson's side of the argument, that the 12-inch pipe-line from Camden to Trenton was paralleled by a single trolley track, and he was told that it is one of the poorest bonded roads in the country. At Camden, they were facing conditions very much like those stated by Mr. Richardson. They had evidence of electric current on the 12-inch pipe-line; for the men working there would see the sparks fly from it very much as Mr. Forstall had described. They had a survey made, and it was shown that the difference in potential at various points ran over 25 volts. Their recording instrument only registered 25 volts, and the needle banked against the top of the scale. There were two power-houses on the line, and the line passed through a number of creeks—completely under some of them; but, as a rule, the soil through which it passed was dry, even sandy. Their Surveyor told them the only thing to do was to bond to the power-house; and they had actually put in a very heavy copper wire running from the pipe to the house. The line had been in operation on this system for three years, and he (Mr. Bunker) had dug up the 12-inch line at several points, and had not been able to discover evidence of electrolysis. Under the conditions faced between Camden and Trenton, the best thing was to bond back to the power-house. They originally had the line laid out on a method of putting in insulating joints, but the plan was not feasible, and they did not have any success until they bonded back as he had stated.

Mr. Richardson said the opinions expressed by him were those of two electrical engineers to whom they referred the problem, telling them their plan of procedure before the decision was made. Therefore, it was not only deduced from the actual experience of themselves, covering a period of 15 months, reinforced with the experiments they made, tabulated, and presented to them, but the deduction from their own scientific point of view.

Mr. E. E. Brownell (Chicago), dealing with the question of electrolysis, pointed out that it was not dependent on the conductivity of the line. He supposed that 99 people out of every 100 went back to the old rule that a current of electricity took all paths available to it, inversely proportional to their resistance and directly proportional to their conductivity. He repeatedly had the nightmare over insulated joints; and this was his first opportunity of saying to the Association that such joints were not worth a cent, and for two reasons, one of which was that they had debarred two classes of mitigation. If one man owned an electric street railroad and another a gas-works, both wishing to work in harmony, they could not do so by using insulated joints. The conductivity of the pipe alone did not govern its rate of depreciation electrolytically, and when once they got away from this they would see the subject in a proper light. He thought the Association would bear him out in the statement—for he had inspected plants covering half the gas-distributing systems of the United States—that there was no subject that was treated with such ignorance as that of electrolysis. He wished it to be placed on record that, in his opinion, the installation of insulated pipe-joints was worthless.

Professor C. F. Burgess, of the University of Wisconsin, on the invitation of the President (Mr. E. G. Cowdery), made a few remarks on the subject under discussion. He said that all could apply Ohm's law to this matter; but in so doing they did not really get any theoretical deduction. They knew that current would leave the rail, and that part of it would travel through the earth back to the station, whether or not they bonded the pipe. Some of the current was going to travel through the earth. If they had pipes along the path which the current travelled, as metals were a million times better conductors than the earth, it followed that, whether they had 18-feet, 500-feet, or 1-mile lengths of pipe, it would offer a better path for the current than the earth; and the pipe would carry perhaps a larger portion of the current. If they used insulating joints and did away with the metallic medium for the current to get back to the rails, they were bound to have electrolysis. This was a fact proved by laboratory studies as well as by practical experience. Where the current left the pipe, it took a certain part of the metal with it. From experience and from every mathematical deduction, it did not seem to him that the insulated joint furnished a solution of the problem; this being found rather in offering a good path for what current the pipe must carry, and a metallic medium for the current to get back to the earth.

Mr. Rice, in closing the discussion, said Mr. Shattuck had mentioned 1¼-horse power per 1000 cubic feet of gas compressed. As this figure had been named before in connection with this particular installation, he (Mr. Rice) attempted to verify it. He took three places, and calculated them as nearly as he could, and they all seemed to converge in the figure named in the paper—viz., at 30 lbs. compression, 1·35-horse power. To this had to be added the loss in friction—*i.e.*, the efficiency of the machine lost through the valve—which should be very slight; but the clearance losses were very considerable as the pressures rose. It was only fair to say that the statements in the paper about graded pipes referred to distribution centres, and not to the main pipe-line. All the main pipe-line at Aurora was graded. They felt that if it was properly graded and taken care of, they would not have any trouble in the distribution centres; and their experience had justified this. He might point out that there were two errors in the appendix to his paper. Easton (Pa.) should have been placed among the "district-governor" instead of among the "direct" systems; and the New Orleans pipe-line was 6 inches, instead of 8 inches as stated.

Natural Gas in Western Australia.—In the Associated Northern Gold Mine, Kalgoorlie, last spring, while sinking a diamond drill borehole from the 1048-feet level, when the drill reached a depth of 687 feet a rush of gas occurred which inflamed on contact with a workman's candle, and was with difficulty extinguished. The flow of gas continued in diminishing quantity for about a month, and then ceased; work being carried on meanwhile with safety lamps.

A CONCRETE RESERVOIR AT ST. HELENS.

By J. J. Lackland.

[Extracts from the Last Paper Read at the Winter Meeting of the British Association of Water-Works Engineers.]

The reservoir which is the subject of this paper was completed in August, 1904, after having been two-and-a-quarter years in process of construction. It has a capacity of 10 million gallons; the interior dimensions being 338 ft. by 315 ft. by 16 ft. depth of water. The site is a plot of land 5 acres in extent, of which the work occupies 2·46 acres. The reservoir is constructed entirely of concrete. The bottom is of concrete 12 inches thick placed directly upon the sandstone rock; the pier walls, carrying the roof arches, are 2 feet thick, and are supported on arches with 11 feet openings, springing from 399 piers, each 5 ft. by 2 ft. The roof is formed of twenty arches, 15 feet span and 12 inches thick at the crown. The main walls are 4 feet thick at the top, and batter on the inside 1 in 8.

The site was favourable for the purpose intended, as the ground to a depth of 5 feet was found to consist of soft material, composed of soil, loamy gravel, sand, and clay, all overlying the Red Sandstone rock, of the Bunter division of the Trias, in beds of varying thickness, through which the excavation was taken down a further depth of about 5 feet—making a total depth of excavation of from 9 to 10 feet; the level being fixed so that the top water-line should exactly correspond with that of the old service reservoir adjoining. This holds 2 million gallons, and is worked in connection with the new reservoir.

It was found from experiment that the sandstone that had to be excavated was of sufficiently good quality for use in making concrete; and sand being also obtainable, partly from a thin bed above the rock and partly from crushed rock, it was decided to build the reservoir from the materials to be excavated. As a matter of fact, the whole of the building materials, except the cement and a small quantity of bricks for the observation houses, were obtained on the site.

The portland cement cost 45s. per ton, and was obtained from Stockton, near Rugby, where it is made from certain beds of the lias formation. The quality specified was as follows: Weight, 108 lbs. per bushel; specific gravity, not less than 3·1; fineness, the whole to pass through 3000 meshes per square inch, with not more than 10 per cent. residue on 5600 meshes per square inch; tensile strength, 450 lbs. per square inch of section on the usual form of briquettes at seven days. The sand was thoroughly washed before being used; and the harder parts of the sandstone were selected and passed through a stone-breaker, and broken to pass a 2-inch ring. The concrete was composed of 4 parts (by measure) of broken sandstone, 2 parts of sand, and 1 part of cement, and mixed in a Carey and Latham mixer with a steam engine and boiler attached. The concrete was put into place partly by means of small tip waggons or skips, partly by means of iron boxes with movable bottoms (these being used for forming the piers), and partly by means of wheelbarrows. It was put in with a fair amount of water, so that it could be made solid by men trampling on it, or by the use of light rammers. The process of putting it in with a smaller quantity of water, and ramming it, was found unsuitable for the material employed, as there was some danger of breaking the sandstone by heavily ramming. Where the work was joined to concrete some time previously built, the older surface was cleaned, roughened where necessary, and grouted, immediately before the new concrete was put in; and the work was allowed to stand generally for one week before the centres or timber casings were removed.

The reservoir was made water-tight by a lining of cement plaster, ¾ inch thick, formed in two coats. The first coat, ½ inch thick, was formed of 1 part of cement and 1½ parts of sand; and the second coat, ¼ inch thick, of 1 part of cement and ¼ part of sand. This lining extends over the bottom and sides, and was formed under the piers before they were built by plastering on the bottom; the plastering being completed as the work progressed.

The work of building was commenced at one end and carried forward as a whole. Thus, after a part of the excavation had been taken out, the side walls were built for some distance in advance; and the roof and bottom were afterwards built in 15 feet lengths extending right across the reservoir. Finally, the roof was made water-tight to exclude the rain, by covering it with bituminous sheeting. As the work advanced, the earthwork covering to the roof was brought on by degrees by lifting material direct from the excavation, and then conveying and tipping it by means of small tip-waggons running on light temporary rails. Ventilation was provided by sixty cast-iron ventilators, three to each arch.

The inlet from the adjacent water-softening works is a 21-inch cast-iron pipe, 280 feet in length. The outlet is formed of two 21-inch pipes passing through the masonry of the reservoir, and is in duplicate to allow for a possible increase in future requirements. These two pipes are then joined to a single line of 21-inch pipes outside the reservoir, which, at a distance of 720 feet, connects to the existing distributing-mains of the town—at this point consisting of one 15-inch and two 12-inch pipes. A length of 520 feet of the 21-inch outlet-pipe is placed in a subway built for the purpose, 14 feet below the surface, at the deepest part, and made of sufficient width to take a second line of pipes when necessary. The subway is also used to accommodate a 15-inch earthenware pipe, which communicates with the sewer to carry off water from the overflow and from the wash-out, which is formed in one corner of the reservoir.

After the reservoir was completed, a test was made by filling it until the water stood just at the level of the overflow notch, and allowing it to stand thus for seven days with all the valves closed, when it was found that the water still kept exactly at the same level; thus showing the work to be quite water-tight. The reservoir has now been in use for more than a year, and remains in perfect order.

The work included 49,500 cubic yards of excavation and 17,500 cubic yards of concrete, in which were used 3600 tons of portland cement. The construction cost is shown in the following table:—

	Total Cost.			Cost per 1000 Gallons Capacity.		
	£	s.	d.	£	s.	d.
Excavation	6,160	0	0	0	12	4
Concrete	13,980	0	0	1	7	11½
Cement plastering to bottom and sides of reservoir	1,256	0	0	0	2	0
Bituminous sheeting on roof	1,270	0	0	0	2	6½
Centreing and plant	1,750	0	0	0	3	6
Castings to inlet and outlet and observation houses	1,180	0	0	0	2	4½
Fencing to land	396	0	0	0	0	9½
Net cost	£25,992	0	0	£2	12	0

In addition to the net cost of the reservoir, there is to be added the cost of two lengths of 21-inch main and connections, the subway, and also of 5 acres of land; the total expenditure on the work being thus brought up to £30,154.

Discussion.

Mr. William Watts (Little Don Valley Water-Works), in the course of a written communication, said that, considering the amount of detail work put into the reservoir, it was a cheap one. One wondered, however, what necessity there was for 399 concrete pillars 5 ft. by 2 ft.; and why the span of the arches was not made larger, with fewer ventilators placed in them. The depth of the reservoir called for economy in the pillars, which he thought could have been made without sacrificing the stability of the superstructure. Personally, he should have preferred them built of bricks. He was sorry Mr. Lackland had not sufficient faith in his concrete to dispense with cement rendering. He wished, too, the author had dispensed with bituminous sheeting in his arches, 12 inches in thickness, covering the reservoir.

Mr. H. Ashton Hill (South Staffordshire Water Company) said he was encouraged to make a few remarks, for not long ago he constructed a 10 million gallons covered reservoir; and the cost was about £30,000, against Mr. Lackland's £26,000. But there were local conditions to cause variation. The reservoir was first constructed as an open one, and was subsequently covered. He was going to criticize Mr. Lackland's piers, and was in agreement with Mr. Watts in that respect. He himself built them with bricks, and they were only 2 feet square, and with a greater span of arches. He would ask Mr. Lackland what percentage of the available water space was occupied by the piers, because when 2 feet square he (Mr. Hill) found it was about 4 per cent.; and he should think 10 per cent. was occupied by the piers in Mr. Lackland's case. He had read a good deal as to sand washing; and it seemed to be quite the fashion to have dirty sand. He supposed it depended upon how dirty it was; but about 10 per cent. of clay appeared to be considered rather an advantage, on the ground that it made stronger work. As to cement rendering, he did not know whether Mr. Watts was thinking about his gravitation reservoirs, when he criticized Mr. Lackland; but he (Mr. Hill) thought, if Mr. Watts had had as much experience in service reservoirs as he had had with gravitation ones, he would not think so slightingly of cement rendering. He (Mr. Hill) certainly thought it was desirable to have cement rendering in service reservoirs. He would not advise any young members of the Association to follow Mr. Watts in this respect. One reservoir that he (Mr. Hill) constructed fell 2 inches fairly evenly; and the salvation of that reservoir was cement rendering. As to bituminous sheeting, in the case of two reservoirs, he had not applied it. He was putting in an asphalte coating—just brushed over as it were, and not anything special. Bituminous sheeting, however, seemed to be in the right place on the top of the arches if special steel girders were used. It prevented the corrosion that was likely to take place by the dripping of water through the roof.

Mr. J. S. Pickering (Cheltenham) put a question or two on some points not appearing in our summary of the paper.

Mr. William Phelps (Wells) referred to Mr. Lackland's statement that the top water-level of the reservoir was made to co-ordinate exactly with the old one. It at first struck him (Mr. Phelps) that it would have been rather more economical if the reservoir had been carried lower into the ground. But when he went into the figures, he found he was probably wrong—that the area of the reservoir was so large, in proportion to the depth, that the cost of the excavation would in all likelihood have counterbalanced the saving in concrete. He should be glad to know from the author whether the position of the water-line of the reservoir with reference to the ground level was fixed absolutely by the old reservoir, and whether he thought that any variation would have resulted in a saving if the other determining factor

had been absent. The cost of the excavation work at 2s. 6d. per cubic yard seemed somewhat high. He took it this was rather more than half rock; but he presumed that the rock might be worth something if got out.

Mr. C. H. PRIESTLEY (Cardiff) also asked why Mr. Lackland had constructed the piers so thick. He (the speaker) had built a covered service reservoir in which the piers were only 18 inches of brickwork. The author had no doubt some good reason for having them of such strength; but to him (Mr. Priestley) they appeared unnecessarily strong. He thought Mr. Lackland was quite right in using bituminous sheeting. He had used it himself on the top of covered reservoirs, and the floors and walls; and very often, where the ground was treacherous, the sheeting was very beneficial.

Mr. H. PRESTON (Grantham) pointed out that the author said the sandstone excavated was of "sufficiently good quality for use in making concrete;" and then later on that "the process of putting it in with a smaller quantity of water, and ramming it, was found unsuitable for the material employed, as there was danger of breaking the sandstone by heavy ramming. If the sandstone was so soft that a little ramming would crush it, would it not be right to infer that it would be dangerous to the concrete when made, as being too soft a material?

Mr. S. R. LOWCOCK (London) criticized a portion of the paper which we have not given.

Mr. LACKLAND, in reply, referring to the question of the size of the piers, and the thickness of the concrete on the roof, said there was not only the necessity for the municipal engineer to satisfy himself that a particular thing was strong enough, but he had to satisfy a great many other people, and work had to look substantial. It was with difficulty that they satisfied the Water Committee that it would stand at all. They could not realize that a concrete structure was a strong thing. After satisfying the Water Committee, they had to satisfy the Local Government Board, who were also dubious as to the strength of the reservoir; and, when the Board sanctioned the expenditure, they took care that the arches should be 12 feet span, instead of 15 feet. This was the principal circumstance why the piers were put in unnecessarily strong. It was, however, perhaps a pleasant feature in the case that the Engineer had to defend himself against having the work too strong and too good. The pillars were not 16 feet high, but about 6 feet, so that they were easily constructed by a box, which took to pieces in four parts. The sand washing was decided upon in the usual course of business and to make sure that they had no dirt in the sand used above the rock. Having washed part of the sand, they washed the crushed rock as well, without doing it any harm. As to the quality of the sandstone, it was not sufficiently strong—it was not like granite or millstone grit. It was a medium sandstone; and there was danger from heavy ramming. Light wooden rammers were used that did not break the sandstone. The concrete was used slightly wet; and after the excellent work they had succeeded in doing with it, he did not see it was worse than concrete made in a different style. The water-tight lining of cement plastering was primarily used to ensure that the 12 inches of concrete on the bottom and half way up the sides should be absolutely tight without a doubt. There was more than half the work—probably three-fourths—where the interior was composed of only 12 inches of concrete; and, in this case, it would have been rash to have run any risk of leakage. The bitumen sheeting on the roof was used to keep out the possible leakage of rain water through the arches, which was not only undesirable in itself, but might cause stalactites underneath the arch, which might weaken it in course of time. The level of the reservoir was made so as to work with the adjoining reservoir still in use; and it was absolutely fixed where it could not get either up or down, because the water-line had to correspond—both reservoirs going up and down in the same degree. But, in order to get the quantity with a 16-feet depth, they had to lower the level of the floor of the new reservoir to 4 feet below the level of the old one, and so, when level, they had 4 feet more water in the new one. The idea of the designer would have been in that case, if he had not been restricted to such an extent, to get the reservoir some 2 or 3 feet higher, so that the quantity of excavation would have been diminished. As it was, going down to the depth they did in the rock, a large part of the excavation had to be employed as spoil; and they could not use it all.

The effect of clay on the tensile strength of portland cement mortar has been investigated in the laboratory of the Office of Public Roads at Washington; and some rather surprising results have been obtained. In a 1 to 1 mortar showing 680 lbs. strength without clay, the addition of varying amounts of clay to the sand caused a maximum loss of strength of 50 lbs., and no appreciable gain. With 1 to 2 mortar having 595 lbs. strength, 3 per cent. of clay in the sand was accompanied by a drop in the strength to 550 lbs., while 16 per cent. of clay gave 615 lbs. strength. With both these mixtures, the influence of clay was not important. With a 1 to 3 mortar, the tensile strength increased from 375 lbs. with clean sand to 555 lbs. with 16 per cent. of clay in the sand, and then fell off to 365 lbs. with 40 per cent. of clay. In a 1 to 4 mortar the increase was from 300 lbs. with clean sand to 445 lbs. with 20 per cent. of clay in the sand, when a falling off commenced that carried the strength down to 270 lbs. with 50 per cent. of clay.

REGISTER OF PATENTS.

Tar Paving.—Ward, J., of Grange-over-Sands. No. 27,308; Dec. 15, 1904.

According to this invention, distilled tar has mixed with it a portion of ground lime, ground chalk, limestone dust, or other analogous alkaline powdered substance; the mixture being made by heating the tar in a suitable vessel or tank, and in this condition adding to it the powdered substance in the proportions required—viz., from 3 parts of tar to 1 part of the powdered substance to 6 parts of tar to 1 part of the powdered substance, the proportion depending upon the class of traffic. The heavier the traffic to which the pavement will be subjected, the greater the proportion of the powdered substance to the tar.

This material is said to impart a greater strength or body to the tar—that is, strengthens its binding capacity and characteristics for this class of paving, and absorbs from it the lighter oils contained in it, and retains its binding qualities. The compound, moreover, does not require to be reheated—that is, while hot it is mixed with the stone used for the paving or macadam, and can be incorporated with the various grades of stone used for the manufacture of the paving. The "prepared paving material can be conveyed from a works, and laid upon any road or street, without the operation and cost of re-heating; and when consolidated with a suitable roller, it will carry heavy traffic."

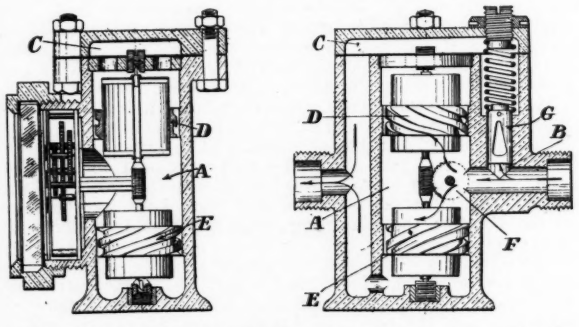
Preparation and Manufacture of Tar Paving.—Ward, J., of Grange-over-Sands. No. 27,309; Dec. 15, 1904.

The patentee describes, in connection with tar paving, a mode of covering or coating of broken stone uniformly with tar adhesive or binding material, consisting in supplying the stone into an apparatus in uniform quantities and proportions over the whole body, and then stirring and turning over same together, "so that the proportions at the several localities at which the stirring and turning over takes place are retained throughout." Such a machine for covering the stone with the tar adhesive or binding material, comprises a horizontally-supported vessel, open along one side, adapted to receive the stone and adhesive throughout the length of its opening in equal proportions, and stirrers mounted on an axial horizontal shaft, adapted to mix the stone and adhesive at different localities along its length—the vessel being adapted to be revolved about its axis for discharging the contents after mixing.

Liquid-Meters.—Petitpierre, C., of Paris. No. 11,450; May 31, 1905. Date claimed under International Convention, May 31, 1904.

This liquid-meter is held to be capable of exactly indicating the quantity of liquid consumed even when the flow is very variable. Means are provided for allowing a portion of the liquid to flow out without passing through the turbines when the flow increases. Also (as a modification), in order to register small rates of flow, means are provided for causing the liquid to circulate in the meter by impulses.

The meter is composed of a casing containing two cylindrical chambers A B and passages, which communicate with the cavity C in the cover. In the central chamber, A is a rotating body composed of a double turbine D E mounted upon a shaft provided with a worm driving the clockwork train of dials through the pinion F. The double turbine is constructed in such a manner as to rotate in a direction determined by the oppositely arranged vanes through the action of the liquid which passes into the central portion. The turbine is constructed of light material,



and is provided with floats for balancing its weight in the liquid. The vanes of the turbine are fixed to the floats and rotate (without touching) in the projecting portions of the chamber A.

The chamber B contains a hollow piston G provided with an orifice of special shape. The piston is pressed downwards by a spring, the tension of which is regulated by a screw stopper; and it is prevented from falling into the inlet passage by a pin which passes through its head and rests against its stop.

The liquid in passing into the space comprised between the two turbines, acts upon the vanes D and E, and rotates the shaft which drives the index. As the liquid acts upon the vanes arranged in opposite directions, and as the weight of the turbine is exactly balanced by the weight of the volume of liquid which it displaces, there is no thrust upon the spindles, and so any wear is considerably reduced.

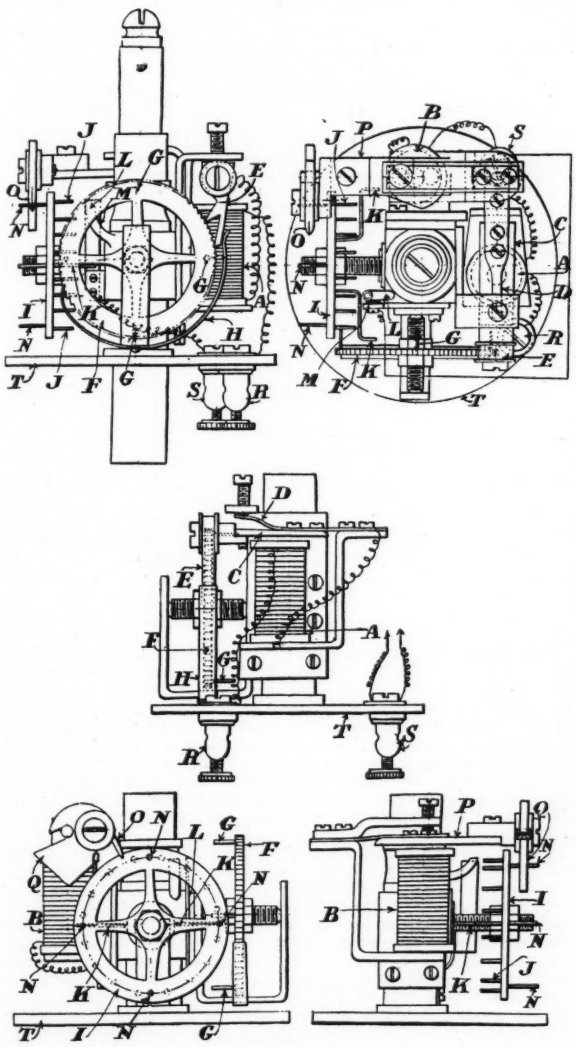
In order to cause the liquid to flow in equal quantities through the two turbines, it is necessary to equalize the loss of head due to the resistance offered to its passage from the upper turbine through the upper passages to the outlet and from the lower turbine through the lower passage to the same outlet. The diameter of the lower passage is chosen accordingly. When the flow of liquid is small, the whole of it

passes through the turbines; but when the flow becomes large, if the liquid had only this passage to flow through the turbine would move too rapidly, and the proportion of the number of revolutions to the flow would not be preserved. The piston G now comes into action. As the speed of flow increases, the difference between the pressure of the supply and that of the delivery sides of the turbine increases in consequence of the increase in the liquid drawn off. The force which acts upon the upper face of the piston becomes weaker than that acting upon the lower face; the spring is compressed; the orifice is opened; and a direct flow towards the outlet takes place. All liquid no longer passes through the turbine, and the speed is no longer too great. If the flow becomes less, the difference between the upward and downward pressure also becomes less; the piston G falls; and the orifice is closed.

The parts of the mechanism for regulating the flow are, of course, calculated in such a manner as to obtain with all rates of flow the proper proportion between the number of turns and the rate of flow.

Igniting and Extinguishing Gas-Jets from a Distance.—Gateau, F., of La Varenne, and Deschamps, E., of Paris. No. 11,596; June 2, 1905. Date claimed under International Convention, Oct. 21, 1904.

This invention relates to apparatus for effecting, from a distant point, the ignition and extinction of gas-jets—the kind in which the gas-supply cock is operated and controlled by electro-magnets, one of which limits the extent of its rotation to a quarter-revolution at a time.



In the engravings are included a front elevation, a corresponding plan, side views in elevation, and an end elevation.

For controlling the burner or jet, there is a tap capable of continuous and complete rotation, so constructed as to twice alternately close and open the pipe during each complete revolution. The tap is actuated by an electro-magnet A; and its movement is controlled and regulated by the electro-magnet B. The armature C of A is provided with a trembler or make-and-break device D; and at its free extremity it carries a pawl E, maintained in engagement with a ratchet-wheel F by the pressure of a spring H. The ratchel-wheel is provided with a number of projections or pins G adapted to engage with pins J carried by another wheel I, which is rigidly connected with the plug of the gas-tap—rotation imparted to the wheel F being thus transmitted to the wheel I.

Upon the side on which the pins J are arranged, the wheel I is also furnished with contacts K—preferably two in number, each in the form of a bent rod, so arranged as to come into contact, when desired, with a link L adjacent to a bye-pass burner M. Upon the other side of the wheel are disposed tappets N—preferably four in number—which, upon the wheel rotating, successively come into contact with a projection O, which partakes of the movement of the armature P of the regulating magnet B.

The armature P has a simple attachment; but the projection O, pivotally mounted upon the armature, is furnished with a counterweight Q. Upon a plate T (composed of an insulating material) are mounted a pair of terminals R and S—the positive terminal S being electrically connected with the link L, and also with the body of the apparatus, by way of the magnet B, and the negative terminal R having a lead from the body of the apparatus by way of the wire of the magnet A.

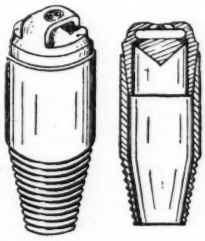
The mode of operation is as follows: If the circuit be closed—say, by a button contact—the trembler D, by its effect upon the armature C of the magnet A, causes the wheel F to rotate through the medium of the pawl E. This movement is imparted to the wheel I and, consequently, to the plug of the burner-cock, to which it is rigidly connected. However, during the moment when the circuit is closed, the armature P has stuck on the core of the magnet B, and the rotation of the wheel I is limited to a quarter-revolution owing to one of the tappets N coming into contact with the lower projection O. Since, however, a quarter-rotation of the wheel corresponds to a period during which the burner-tap is opened and the burner-jet ignited, one of the two contact-rods K will have engaged with the link L and produced, by reason of the electrical connections already described, an extra-current spark, thereby igniting the gas passing through the bye-pass M. This latter device is arranged upon the side of the burner-tap remote from the source of gas supply. By a suitable arrangement of the plug and its seating, the bye-pass orifice may be opened before that of the principal burner; so that the bye-pass burner will have been ignited for a short time before the full opening of the burner-taps—loss of gas being thereby prevented.

The burner having been lighted, the contact button is released. The armature P becomes detached, and at the same time raises the projection O. This latter, which had oscillated slightly under the pressure of the tappet N, then resumes its original position under the influence of the counterweight Q.

When it is desired to extinguish the light, the contact button is again pressed—a further quarter-revolution of the wheel I being thereby caused. This movement the wheel will be able to make on account of the projection O, in consequence of the sticking of the armature, being now situate behind, instead of in the path of, the tappet N. This second movement on the part of the wheel I, which is again limited by the projecton O, has the effect of closing the burner-tap, and, consequently, of extinguishing the burner-flame.

Burners for Gases of High Illuminating Power.—Weber, G., of Nuremberg, Germany. No. 15,317; July 25, 1905.

The object of this invention is more particularly to provide a burner-head adapted to prevent the choking of the gas-orifices with soot even when the burner is used with considerably fluctuating gas pressure.



Into the burner-nozzle is inserted the lower part of the burner-tip of the ordinary shape. A comparatively wide vertical passage extends through the greater part of the tip; and the cover of the latter can, if desired, be in the form of an inverted cone. The wide passage in the interior of the tip communicates at its upper end with narrow ducts—for instance, two—converging towards the central axis of the burner; the arrangement being similar to that of the "Manchester" burner. By this means, two gas-jets are caused to impinge against each other a short distance above the ducts, so that a flat flame is obtained. A bow-shaped superstructure is arranged above the ducts, the central part of which has two ducts or orifices, the geometrical axes of which correspond to those of the converging ducts, and which are of larger diameter than the latter. The ducts terminate in a shallow recess or depression formed in the upper surface of the bow-shaped part. The gas-jets leaving the ducts therefore pass through an open space, in which they are "entirely surrounded" by air before the gas can enter the ducts or orifices above which it is ignited. The recesses allow the air to have direct access to the root of the flame, "so that the latter acquires very high illuminating power." Tests, it is said, have shown that, owing to the arrangement of the bow-shaped part and of the space below, the flame does not "flash" back to the ducts even with low gas pressure; and, when "turned down," the gas burns with a blue flame.

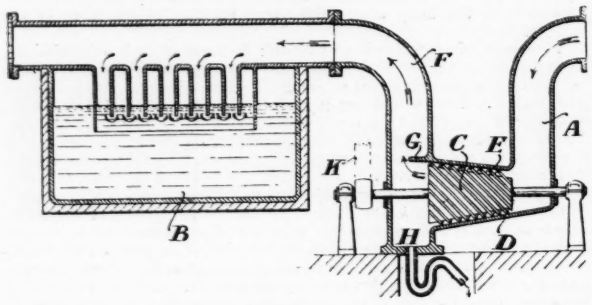
Extracting Ammonia from Distillation Gases.—Brunck, R., of Dortmund, Germany. No. 15,646; July 31, 1905.

This invention relates to the extraction of ammonia from the hot gases produced by the dry distillation of coal, wood, peat, and other substances; the hot gases being washed with concentrated acid. It has for its object to improve the process "so that the acid is completely and solely used for the absorption of ammonia, and that, moreover, the ammonia salt can be purified quicker and in a more simple fashion."

With the process hitherto practised, the hot gases meet the concentrated acid prior to being deprived of their contents of tar. The consequence is that part of the acid is consumed in combining with the basic constituents of the tar—such as pyridine-bases, &c.—while another part of the acid mixes with the condensed tar and is carried away by it. Moreover, as the patentee points out, the presence of tar in the acid or ammonia salt solution has the bad effect of soiling the ammonia salt, whereby its purification requires more work and time.

In order to avoid these inconveniences, the present invention consists in treating the hot gases before meeting the acid (so that the tar is removed as thoroughly as possible without wasting any ammonia) by subjecting them, on their passage from the retorts or other distilling

vessels to the absorbing apparatus, to centrifugal action at such a temperature as will prevent the water vapours in the gas from being condensed—that is to say, of over 100° C.—in order that no absorption of ammonia by water can take place, but all is retained in the gas. In this way, it is said to be possible, without any loss of ammonia, to remove the tar from the hot gases to such an extent that only a very small proportion of it is left in the gas to be condensed in the acid; moreover, the remaining tar is separated in such a liquid state that it easily flows off from the surface of the acid in the washer.



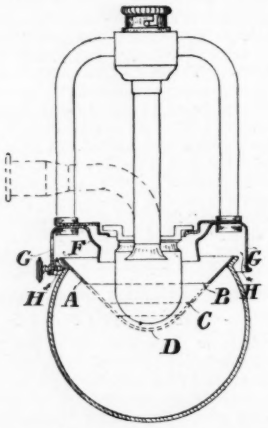
A is the conduit through which the gas arrives from the distilling apparatus, and B the washer (of known construction) supplied with concentrated acid—for instance, sulphuric acid. As shown, the gas-conduit opens into a centrifugal apparatus composed of a conical drum C rotating within a conical casing D, which communicates with the gas-conduit by its narrower end. The drum is provided on its surface with spiral ribs or beaters E, which extend to a short distance from the inner side of the casing. The latter opens with its wider end into the gas-conduit F communicating between the centrifugal apparatus and the washer. Preferably, a tossing plate G is disposed within the conduit about the mouth of the casing. The conduit is extended downward, in order to form a tar-collecting chamber H provided with a syphon outflow. The centrifugal apparatus is driven by means of a pulley and belt K.

The hot gases supplied to the apparatus by the conduit A pass between the casing and the drum by being dissipated in as many spiral currents as there are ribs E. The drums being rotated at a rapid speed, the currents of gas are subjected to centrifugal action, with the effect that the vaporous tar in the gases is progressively condensed, and finally ejected into the chamber H (whence it flows off through the syphon); the hot gases passing up through the conduit F into the washer B. During its passage through the apparatus, the gas is kept at such a temperature as will prevent the water vapours in the gas from being condensed—that is to say, of over 100° C.—so that no loss of ammonia can occur.

Inverted Incandescent Gas-Lamps.—Steinicke, G., of Berlin. No. 15,919; Aug. 3, 1905.

This inverted lamp has its air for combustion drawn in at the top into a preliminary heating chamber (arranged in the globe gallery) "bordered above and internally by means of an insertion surrounding the foot of the incandescent body."

In order to secure that the air drawn from this preliminary heating chamber should first partly flow down on the inner walls of the closed globe, an insertion ring A is arranged on the upper edge of the globe, preferably in the form of a truncated cone. The air is directly conveyed laterally against the incandescent body over this superposed ring,



without a portion of it flowing down the inner walls of the globe. The ring is made preferably of glass, mica, or the like, or of metal, when its under edge only extends to the line B. It may be prolonged to the line C, or, in special cases, to the point D, so that is surrounds the incandescent body below, and forms a second smaller globe.

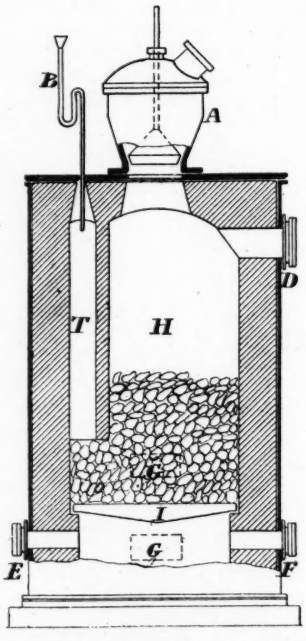
Independent of the distance to which the lower edge of the ring lying on the glass globe extends, the ring prevents the air flowing along the inner wall of the globe being carried against the incandescent mantle in opposition to the mixture of gas and air flowing downwards from the mixing-tube.

The insertion F, which encloses the foot of the incandescent body, is arranged in the burner gallery, and closes the preliminary heating chamber above and also partially at the sides, in order to prevent the air escaping from it, and to cause it to pass in the shortest course, in the direction of the arrows, laterally against the mantle.

The air can enter through a lateral perforated gallery at G or beneath the end of the gallery at H.

Production of Carburetted Generator or Water Gas.—Hutmacher, J. A., of Berlin. No. 19,995; Oct. 3, 1905.

For manufacturing carburetted generator or water gas, the following two methods have been suggested, says the patentee: Either the hydrocarbons were vaporized separately and added to the prepared generator or water gas after leaving the column of coal, or else in its uppermost layer. The mixture was then fixed in a special chamber filled with incandescing bodies. Or else the hydrocarbons were conducted into the combustion zone, where they were for the greater part consumed, and did not so much carburet the heating gas with gases rich in carbon as increased the percentage of carbonic oxide and hydrogen. In accordance with the present invention, the carburetting medium is likewise conducted into the incandescent layer of coal, but above the oxidation zone, into the reduction zone. The burning of the hydrocarbons is thereby prevented; but they are nevertheless submitted to a sufficiently high temperature to become converted into permanent gases—"apparently assisted owing to the fact that the hydrogen liberated in the reduction zone acts *in statu nascendi* on the heavy hydrocarbons, with the formation of lighter hydrocarbon gases, but without separation of carbon."



The process is preferably carried into practice in a generator of the following construction: The grate is closed air-tight at its upper part by the charging hopper A. The syphon B serves for the supply of hydrocarbons, and a chamber C for the vaporization and superheating of the carburetting medium. The chamber H, for the solid fuel, has at the bottom a grate I, clinker and ash doors G, and the admission and discharge conduits D, E, and F. With hot-blowing, air enters through F, while the combustion gases pass away through D. With gases, on the contrary, water vapour enters through E and oil vapour through C; the carburetted water gas passing off through D in the form of permanent gases.

In this connection it should also be stated that with hot-blowing by means of the air entering, any solid or viscous deposits may be preliminarily burnt in the chamber C.

In addition to these "important constructional simplifications of the gas-generator," this process is said to present "the great advantage that the quantity of carburetting material required is reduced quite disproportionately, as compared with other hot carburetting processes, because (1) the carburetting vapours only experience a single heating and cannot be consumed, and because (2) the formation of the permanent gases is far more complete, owing to the fact that the carburetting vapours encounter the water gas at the proper temperature of its generation phase."

Lighting or Extinguishing a Number of Lamps Simultaneously.—Anderson, J., and Bennet, J. H., of Edinburgh. No. 24,196. Nov. 8, 1904.

This invention relates to apparatus for automatically lighting or extinguishing gas-lamps, having a bell which is loaded so that it shall not lift until the normal working pressure is exceeded, inside of which bell there is an element adapted at one temporary increase of the gas pressure to operate a valve which opens the gas supply to the burner, and at the next temporary pressure increase to close the valve.

Fig. 1 shows sectional elevations at right angles to each other of the form of the invention in which a lift valve is used.

Fig. 2 is a sectional elevation through a modified form of apparatus in which the mechanism is arranged in a very compact form.

Over a vessel of preferably circular form is a gas-bell, loaded so as to suit the pressure at the part of the district at which it is applied.

The bell is sealed by dipping into liquid contained in an annular space surrounding the vessel, and is guided by spindles working in recesses, so that it shall always travel in the same vertical path without circumferential displacement. At the centre of the inside of the top of the bell is loosely pivoted a link E carrying a roller F at its end. The link may be made by a wire bent into the form of a rectangle; the upper short side being supported in a bracket G carried by the bell, while the lower short side has the roller threaded over it. The link is thus like a pendulum, and may swing freely to and fro in the vessel from its pivot on the moving bell. In the base of the gasholder there is a

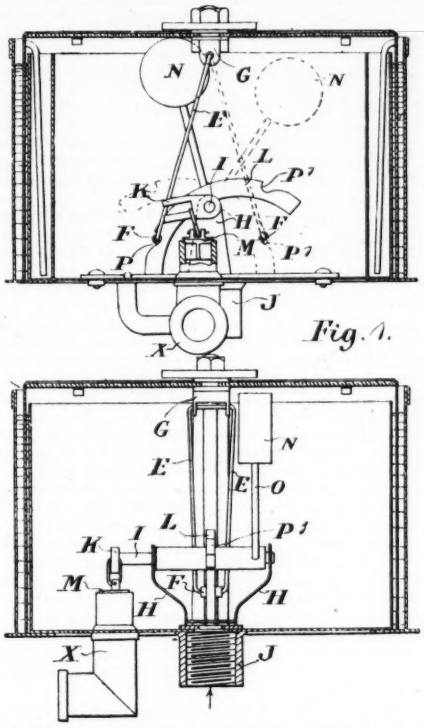


Fig. 1.

bracket H supporting a spindle I, provided at one end with a slotted crank K adapted to operate the valve M through which the gas supply to one or a number of lamps passes. The gas from the mains is led into the vessel closed by the bell, or the gasholder, by the pipe connection J, preferably in the bottom of the vessel; and it passes from the bell to the burner by a pipe X.

The spindle mentioned above is provided with a weight N on an arm I, and carries a segment L or a ring provided with two notches P and P^1, which open from the convex side of the segment, and are placed at equal distances along the curve, one on each side of the spindle. This segment is placed so that the roller F of the pendulum link engages with the convex surfaces, and in the lowest position of the bell with one of the notches in the segment.

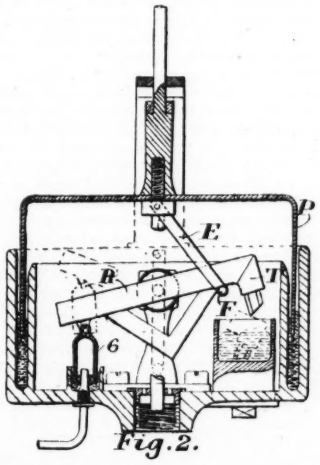


Fig. 2.

In this way, when the bell is raised by a temporary increase of pressure in the mains, the pendulum link lifts the segment and rotates the spindle sufficiently far that the centre of gravity of the weight is on the opposite side of the spindle from the engaging notch. The spindle will then be moved round under the action of the weight until stopped by the end of the segment which was originally highest coming in contact with the base-plate in the position shown by the dotted lines. This movement causes the slotted crank to move through a certain angle, so as to open the gas-valve M and disengage the free end of the pendulum link from the notch P; so that, when the temporary increase of pressure is shut off, the bell falls, and the pendulum link engages with the notch P^1 on the other side of the spindle. The links are then in a position to close the valve at the next impulse, or on any temporary increase of pressure; and in this way a reciprocating motion is transmitted to the valve.

In the modification shown in fig. 2, the pivotally carried tube R is provided with a triangular shaped cam or guiding edge on its under side. This cam causes the arm or pendulum link E to be deflected on the right and left alternately of the centre of the pivot about which the tube R oscillates. Thus, when the bell is collapsed or in its lowest position, the link hangs vertically downwards, as shown in the dotted lines. In the position illustrated, the open tube end T is out of the seal U, and the apex of the triangular cam is on the right of the link. If, now, the bell rises, and consequently raises the end of the link, the roller F will slip along the left inclined face of the cam until it reaches the shoulder, when further upward movement of the link will tilt the tube R to the position shown by the dotted lines. When the pressure is released, the bell will fall, and the apex of the triangular cam will now be to the left of the link. In this way, the opening and closing of the gas supply is effected as in the type described above.

APPLICATIONS FOR LETTERS PATENT.

26,313.—Foulds, J. T., "Gas-burner." Dec. 18.
26,331.—Brooks, B. W., "Inverted burners." Dec. 18.
26,345.—Rushmore, S. W., "Acetylene-generators." Dec. 18.
26,407.—Helps, G., "Screens for burners." Dec. 19.
26,408.—Helps, G., "Bunsen burners." Dec. 19.
26,447.—Harris, J. W., and Sawford, F., "Calorimeters." Dec. 19.
26,467.—Nehmer, H., "Lighting of gas." Dec. 19.
26,484.—Biheller, S., "Rings for mantles." Dec. 19.
26,535.—Bartlett, J., "Acetylene-generators." Dec. 20.
26,572.—Pearson, J. S., "Mixing combustible gases with steam and air or the like, and consuming them." Dec. 20.
26,666.—Dibdin, W. J., and Woltereck, H. C., "Production of permanent illuminating and heating gas." Dec. 21.
26,731.—Keats, R. F. C., and Wood, T., "Gas-engine." Dec. 22.
26,763.—Tangyes, Ltd., and Pitt, J. H., "Gas-producer." Dec. 22.
26,810.—Jones, D., "Meters." Dec. 22.
26,827.—Davey, W., "Inverted burners." Dec. 23.
26,829.—Fielding, J., "Suction gas-generators." Dec. 23.
26,839.—Mercer, A., and Meters, Ltd., "Gas-delivery mechanism." Dec. 23.
26,843.—Beal, W., "Inverted gas-lights." Dec. 23.
26,847.—Green, B. K., and Mieville, H., "Petrol gas." Dec. 23.
26,861.—Hill, H., "Generating acetylene." Dec. 23.
26,862.—Hill, H., "Gas-valve." Dec. 23.
26,882.—Murinick, A., "Compressed-air burner." Dec. 23.
26,899-900.—Browne, A. F., "Treatment of spent oxide." Dec. 23.
26,909.—Wasmuth, A., "Firing mantles." Dec. 23.
26,930.—Bury, E. and Brown, H., "Carbonizing coal." Dec. 23.
26,932.—Rose, A., and Bellamy, W., "Inverted burners." Dec. 27.
26,948.—Booth, W., and Pye, R., "Incandescent lighting." Dec. 27.
26,950.—Wilson, L., "Gas-turbines." Dec. 27.
26,998.—Clarke, F., "Purification of gas." Dec. 27.
27,021.—Verges, O., "Incandescent light." Dec. 27.
27,060.—Ashworth, J. R., "Mantle support." Dec. 28.
27,130.—Huber, G. W., "Gas-irons." Dec. 29.
27,139.—Duffied and Sons, Ltd., and Upton, J., "Mantle protector." Dec. 29.
27,143.—Sylva, S., "Acetylene apparatus." Dec. 29.
27,146.—Maurin, L., "Gas advertisements." Dec. 29.
27,184.—Cox, F. J., "Gas-producer." Dec. 29.
27,212.—Lewis, T. H., "Producing acetylene," Dec. 30.
27,213.—Bellamy, A. R., "Internal explosion engines." Dec. 30.
27,216.—Wright, J. B., and Darwin, H., "Inverted burners." Dec. 30.
27,272.—Gadda, G., "Gas-turbines." Dec. 30.
27,280.—Fitch, W. B., "Incandescent burners." Dec. 30.
27,286.—Cox, F. J., "Burners." Dec. 30.
27,290.—Horstmann, A., S.A., G. O. H., & E. H., and Edgar, W. T., "Time switches for gas or other agents." Dec. 30.

Public Lighting in Hammersmith.—The report of the Hammersmith Borough Council for the past financial year shows that the total number of incandescent gas-lamps in use in the streets of the borough was 1241, of which 1073 were in the Brentford Company's district; and that the total amount paid to the Company during the twelve months was £2773 12s.

Burley-in-Wharfedale Gas Supply.—The Burley-in-Wharfedale Urban District Council recently gave notice to terminate the agreement with the Otley Gas Company for a supply of gas; and they have now asked the Ilkley Urban District Council to furnish them with gas in bulk. Though the arrangement will involve the laying of over 3000 yards of main, at a cost of about £1700, the Ilkley Council are prepared to supply gas at 2s. 6d. per 1000 cubic feet, or 1d. less than Otley, providing the Local Government Board will sanction the necessary borrowing powers.

Conditions of Employment at Pontypridd.—At the last monthly meeting of the Pontypridd Urban District Council, Mr. Morgan proposed that their new Gas Manager should be engaged at a salary, *plus* commission on profits. Several members, however, took exception to the introduction of the principle of commission; and it was ultimately resolved to advertise the position at an inclusive salary of £300. Mr. Williams then moved that in future all persons appointed by the officials of the Council must have been residents within the Council's area for twelve months prior to the appointment. He said he knew of absolute strangers being taken on when residents were anxious for the work. Mr. Bramwell thought that such a restriction would be inadvisable; but after a lengthy discussion, the motion was adopted by nine votes to six.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by Correspondents.]

Naphthalene Experiences at Sheffield.

SIR,—Referring to the remarks in the leaderette on the above subject in the "JOURNAL" for the 2nd inst., I may say that, in addition to sending gas through the driving-main, each works supplies a separate district of its own, which do not intercommunicate; but, for economical reasons, we do not always in the autumn and winter months make sufficient gas at the Effingham Street works to meet the demands of the district supplied from that station, and gas is delivered from Grimesthorpe into a holder there. We have three governors at Effingham Street; and by confining the gas sent from Grimesthorpe to the No. 3 governor, we have satisfied ourselves that the number of complaints has not been increased by the mixture of the gases.

Sheffield, Jan. 4, 1906. HANBURY THOMAS.

SIR,—I read with deep interest the instructive article on the above subject by Mr. Hanbury Thomas, published in your issue of the 2nd inst. I did so for various reasons, but mainly because I was personally consulted in regard to the matter, shortly after the commencement of the trouble, by Mr. Fletcher W. Stevenson, who was then the Engineer of the Sheffield Company's works.

In a paper which I had the honour to communicate to the Incorporated Gas Institute at the meeting in 1900, I referred to that consultation, and drew special attention to Mr. Stevenson's wonderful faculty of observation in regard to the effect of the different systems of condensation at the various works which he had visited had upon the relative presence of, or freedom from, difficulties from naphthalene deposits. Mr. Stevenson had observed that in the works where condensation was carried on on what was universally believed to be the best principle—that of slowly cooling the gas, and removing the liquid tars as they were precipitated—it was found that the troubles from naphthalene were greatest. On the other hand, in those works where the gases and condensable products were suddenly cooled, and no attempt made to fractionally separate the tars from the gas as they were formed, the troubles from naphthalene deposits were least. In the same paper, I gave what appeared to me to be a logical explanation of the cause of these different results—that in those works in which the gases were cooled slowly and the tars precipitated and removed from contact with the gas while comparatively warm, the best practicable conditions were provided for restricting the solvent power of the tars and preventing them from absorbing the naphthalene vapours from the gas. But in those works which were provided with condensing arrangements, in which the gas and products were suddenly cooled, the tar vapours would be reduced to the liquid condition, but in such an extreme state of division that they would, in consequence, be carried forward in the current of gas, and the gas and tar would therefore be kept in contact till they were cooled to a much lower temperature—thus allowing these finely-divided tar particles ample time and opportunity for absorbing the naphthalene vapours out of the gas, before they were finally precipitated and removed.

I have on various occasions since that date drawn attention to evidence of the correctness of these logical deductions—more particularly in an article which appeared in your issue of March 14 last, where reference was made to Mr. A. F. Browne's graphic description of his practical experience in connection with the different methods of condensation obtaining at the Vauxhall and Bankside works of the South Metropolitan Gas Company. These experiences demonstrated conclusively the advantages of sudden condensation and keeping the tars in contact with the gas in preventing naphthalene deposits. These remarks apply to the experiments made at Sheffield in the way of hot condensation, and explain why, instead of benefit resulting from scrubbing with hot tar, the reverse was found to be the result.

As your readers are aware, one of the methods of applying the Young and Glover process of solving the naphthalene problem—that which had proved successful at St. Helens, of obtaining the necessary naphthalene solvent by carbonizing a small quantity of cannel at a suitable low temperature—was introduced into the Sheffield works; but after being in operation for a short time, and because it did not give immediate relief, it was abandoned. At that time, and on various occasions since, I have very fully explained why, owing to large accumulation of naphthalene in the trunk mains, &c., previous to the introduction of a process, it cannot be expected that any system will give immediate relief, as, though the gas may leave the works in a condition that would not give trouble during distribution, yet on coming in contact with these previous deposits it becomes re-charged with naphthalene so as to give trouble in the terminal mains and services; and freedom from naphthalene will only be attained when these deposits are dissipated by being carried away in the gas, or on being dissolved and washed into the drip-wells.

The interesting and instructive article of the experiences of the Colson and of the Bell processes at Sheffield, which we are now considering, supplies conclusive evidence of the soundness of my argument in explanation of why the St. Helens modification of the Young and Glover process failed to give, on its introduction in the Sheffield works, immediate relief; for we have Mr. Hanbury Thomas's statement that —"Both these processes were experimented with in 1904; but the results then obtained were not so satisfactory as they have been during the past year. In fact, so far as Mr. Colson's process is concerned, no benefit was derived from it whatever; and the opinion of Mr. Colson, and of the Company's Engineer (Mr. J. W. Morrison), was that the cause of its failure was due to its not having been started until late in the season (Aug. 11), when a considerable deposit of naphthalene was in the mains." On starting both processes at an earlier date next year, before such deposits of naphthalene had occurred, both processes were found to give good results, lowering the complaints to less than 5 per cent. of what they had been the previous year. Mr. Hanbury Thomas tells us that, "as regards effectiveness, there does not appear to be much to choose between the two systems."

Now, these statements of Mr. Hanbury Thomas's are in several respects instructive. They show that had the Colson system, after being tried in 1904 and found to have no beneficial effect whatever, been abandoned for good, as was done in the case of the St. Helens modification of the Young and Glover system, both these processes would have been unfairly abandoned for a like cause—that their good effects were neutralized by the considerable quantities of naphthalene that had been previously deposited in the mains. It will further be observed that, while both systems gave equally good results in 1905, when started and worked with naphthalene-free mains, yet Mr. Bell's process gave more favourable results when tried in 1904 with the mains containing naphthalene. Now what is the cause of this difference? It will be remembered that the Young and Glover process is founded upon the action of two fundamental principles—the first being to wash the naphthalene out of the gas in any convenient washer or scrubber, by means of a supplementary supply of any suitable solvents; the other to volatilize into the gas the vapours of naphthalene solvents having a similar vapour tension, so that they may condense along with the naphthalene and take it up in solution.

In a discussion which appeared in your "Correspondence" columns about a month ago, regarding the composition of the solvents used respectively in the two systems, the fractional distillation analysis given by Mr. Colson and by Mr. Bell are not quite in accord with each other. But they have this in common—that they both consist of the distillates of coal tar boiling between 160° and 215° C.; the essential difference between them being that the fluid used in Mr. Bell's system contains a much larger proportion of the fractions distilling at the lower temperature. As is well known, the lower the boiling-point the higher the tension of the vapour of the fluid, and, in consequence, the larger will be the quantity of vapour diffused through the gas. Now it is practically admitted that, by both systems, the solvent fluids act in accordance with both the principles of the Young and Glover process. They both wash a portion of the naphthalene vapour out of the gas; and at the same time the gas, in passing through the fluid, takes up in diffusion the vapours of the more volatile naphthalene solvents. It will be evident, however, as the fluid used by Mr. Bell contains the largest proportion—practically double the quantity—of low boiling-point solvents, that while equally, if not more, effective in washing the naphthalene vapours out of the gas, the gas will at the same time take up in diffusion a much larger quantity of the vapour of the naphthalene solvents. Mr. Bell's system would, therefore, act more quickly, as the presence of the extra quantity of the vapours of the naphthalene solvents would to some extent counteract the effect of the naphthalene previously deposited in the mains. This difference accounts for the more favourable results obtained from the trial of Mr. Bell's process in 1904.

Though, however, the fractions of the tar distillates selected by Mr. Bell make their action more quickly manifest, the fractions used by Mr. Colson, while slower in showing their effects, owing to it being to a greater extent a washing process, yet both processes would be equally effective once the distributing mains were free from naphthalene deposits. Neither of them, however, would be any more effective than, even if so effective as, the tar distillates described in the specification of the Young and Glover patent, consisting of the whole of the early parts of the distillate of the tar—the naphthalene present in the heavier fractions having been removed by refrigeration and filtration. Once the fundamental principles on which a supplementary supply of liquid solvents can be used so as to solve the naphthalene problem are clearly explained, and examples given of how fluids from different sources can be prepared and used, it is evident that they are susceptible of application in various ways; and therefore the claims being made for the use of the different grades of the distillates of coal tar, because the first drop comes over at a particular temperature, and because the fractions having different boiling-points are present in different proportions, are thus seen to be simply absurd.

With regard to the statement made by Mr. Hanbury Thomas that it was formerly considered that naphthalene was deposited in the mains in the winter months, I have to remark that, in my before-mentioned paper to the Incorporated Gas Institute, I fully explained that the temperature conditions were not such as to cause the naphthalene to deposit in the mains during the winter months, but that they were so during the late spring and early summer; and that the temperature conditions were such during the autumn and early winter months as to cause the previously deposited naphthalene to revolatilize into the gas and give trouble by being redeposited in the exposed services, &c.

I need not say that I do not agree with the concluding paragraph of Mr. Hanbury Thomas's article—that I do not admit that either Mr. Bell or Mr. Colson independently "worked out the most difficult problem;" for, as already explained, the working out of substantially identical processes with those which I frankly admit and credit them with being the means of introducing to the Sheffield works had been fully described in the specifications of the Young and Glover patent and other publications.

Peebles, N.B., Jan. 5, 1906. WM. YOUNG.

Mr. Forstall's Method of Charging for Gas.

SIR,—I am very glad that Mr. Forstall has not taken offence at my hilarious criticism of his paper on "Methods of Charging for Gas," as propounded at the meeting of the American Gaslight Association in October last. Many a one less level-headed and sensible might easily have resented my tentative "method of charging" against a powerful American windmill. Had that been the case, there is no knowing but I might have come to grief (as did the Don) in such an encounter. It appeared to me, however, that there was so much of unsatisfactory plausibility, along with a great deal of very fine spinning in the theory, advanced by Mr. Forstall, that a little mild banter, rather than close argument, was needed to expose its practical deficiencies.

When a theory has been adopted as having the probability of right

on its side, there is the tendency with some minds to attenuate it to breaking-point, instead of so modifying it as to make it workable. We are not ignoring the theory by thus making it applicable to the stress of every-day life. Now, I say that it is not within the range of practical working, even if Mr. Forstall's contentions and calculations are correct, that one man should be charged, and consent to pay, $5 for that for which a neighbour is called upon to pay only $1·75. It is folly to waste time in exposing what is self-evident—viz., the fallacy which assumes such a variation in charge to be possible or proper in any country, or among any community where there is freedom of choice and action. Be the consumption great or small, it is in both cases made up of units; and if the total of one consumer is less than that of another, so the total capital outlay to supply him is also less.

When a new gas-works is being designed, the engineer does not ask the question, "How many consumers will there be of this, that, and the other yearly quantity?" but "What will the probable total yearly consumption be?" And so he matures his plans accordingly. On the works being completed and put into action, and a revenue begins to accrue, the only question the manager need consider in regard to price as between the very large consumers and the smaller is, "What saving is there in sundry items—such as cost of distribution to, cost of collection from, &c.—with a consumer whose consumption so overtops the average as to justify a discount?" The term "large," as here applied, can only be used in a relative sense. Each manager, taking account of the circumstances, must settle the question as it concerns his own particular district. What is large in one might be looked upon as small in another, and *vice versâ*. Graduation in charge for the host of consumers is out of the question; and to attempt it is to land oneself in a quandary, as Mr. Forstall will find if he pursues his experiment for any length of time. The experiment, however, may be useful for this very reason.

There are causes always at work tending to vary the consumption of any consumer between one quarter and another, and from year to year. The consumer of 100,000 cubic feet in one year may require double that the next; or his consumption may fall off to almost *nil* at another time through temporary causes. To subject any such to the shifting sands of variableness in the charge, would be intolerable—unless, indeed, he were willing to find the reason for this variation in the perusal of an elaborate essay, a copy of which might be politely handed to him on his making complaint of what he would rightly consider an exaction.

It appears that, after all, I expressed myself as thinking too favourably of Mr. Forstall's scheme. He does not base his diminishing charge system on quantity alone. I confess, then, that I am at a loss to follow him, and, indeed, I do not care to do so. The hedging of any scheme about with exceptions makes it difficult to understand.

For an answer to the question asked in the last paragraph of his letter, I refer Mr. Forstall to my paper and the arguments therein contained. I need not repeat them here. He will find that I am opposed to discounts, either large or small, being allowed to certain consumers, even when their consumption is heavy. And, further, that where a discount is properly due—to a large all-the-year-round consumer, for example—it should be a moderate one, strictly regulated in amount by the saving in outlay which the consumption secures.

Finally, let me say that the gift of a fertile imagination is good; but it must not be allowed to run away with our common sense. I don't care to know, or to argue, how many angels can balance themselves on the point of a needle at one and the same time. Even in those cases where a theory can be proved faultless, we should, in applying to it every-day concerns, keep the practicable in view, if our words or personality are to have weight.

Manchester, Jan. 4, 1906. THOMAS NEWBIGGING.

The Salaries Question.

SIR,—Referring to the recently published correspondence on the subject of inadequate salaries, I venture to propose a scheme for the remedy of this grievance. The payment of inadequate stipends, which is not confined to assistant engineers and managers, is spasmodically ventilated from time to time, and nothing more is heard of the subject. Not only are places advertised at unfairly low salaries, but in many cases the post is practically put up to tender.

We have the remedy in our own hands; and it is high time that gas engineers, managers, and assistants should combine to secure adequate and just remuneration for their services. That combination can confer great advantages on those who are sensible enough to combine, has been made apparent to all by the prices realized for years in the gas-meter, tube, and other trades, and also by the increased wages earned by gas stokers and all other Trade Union men.

Almost every engineer, manager, or assistant of a gas undertaking is a member of the Institution of Gas Engineers or of one of the affiliated Associations. It is the duty of these Associations to make an effort to improve the status and remuneration of their members, the majority of whom are highly trained technically, and give their whole-hearted attention to their profession. The members must bring the matter forward at this year's meetings, and bring pressure to bear on the members of the Councils of the different Institutions to appoint a fully representative Committee to deal with the question of salaries. Members do not pay their subscriptions simply to hear papers read and discussed—this benefit can be derived by reading the "JOURNAL"—but to meet and exchange ideas. The best of comradeship exists between members, and such *camaraderie* should be put to a useful purpose.

It seems to me to be the obvious duty of the parent Institution to draw up a scale of salaries for managers and assistants, for the guidance of the proprietors of gas-works who do not appear to have any idea of the salary they should pay, and that such scale should be adopted by every member of the Institution and its affiliated Societies as the minimum which they will "quote" in making application for a position which is advertised on the principle of "the lowest tender will be accepted."

Let us ventilate this matter thoroughly in your columns and persevere until a *modus operandi* is arrived at.

Jan. 6, 1906. LUX.

Water-Works Engineers and Lead Poisoning.

SIR,—At a recent meeting of the British Association of Water-Works Engineers, reported in your last issue, Mr. W. G. Peirce, of Richmond, who held office at Canterbury for five years (not nine, as stated), is reported to have said "the only case of lead poisoning he heard of there was in connection with a lead cistern on the water-works."

I desire to say that no case of lead poisoning has occurred or been suspected, either during Mr. Peirce's service here or since. As Mr. Peirce left the Company's service thirty years ago, I think he must have been labouring under some delusion when he made the statement. On the opening of the new water-works in 1869, I, by order of the Directors, caused a careful test to be made by a chemical expert, to ascertain if the softened water had any action upon lead, when it was clearly shown that no such action took place. Lead services were then adopted, and have been in use ever since—a period of 37 years.

JAMES BURCH,
Canterbury, Jan. 5, 1906. Secretary and General Manager.

LEGAL INTELLIGENCE.

WEST RIDING QUARTER SESSIONS, LEEDS.

(*Before Mr.* G. B. COOKE YARBOROUGH *and a Bench of Magistrates.*)

Tuesday, Jan. 2.

Bradford Water-Works Assessment Appeal.

This was an appeal by the Bradford Corporation against the poor-rate assessment on the Leeming and Leeshaw compensation reservoirs and part of the Thornton Moor reservoir situated within the Keighley Union. The rateable value had been increased by the authorities from £4072 to £6200, and the gross value from £5429 to £8267.

Mr. BALFOUR BROWNE, K.C., and Mr. F. WOOD appeared for the Corporation. The respondents were represented by Mr. HORACE MARSHALL, K.C., and Mr. R. WATSON.

Mr. BALFOUR BROWNE, in opening the case, said that what the Court had to determine was the rateable value of those portions of the water-works which were in the parish of Oxenhope, in the Keighley Union—that was to say, a part of the Thornton Moor reservoir and the Leeming and Leeshaw compensation reservoirs. These works were authorized by an Act passed in 1869. The cost had been considerable; that of the Thornton Moor reservoir especially being extraordinarily large—£176,520, or double the original contract—in consequence of difficulties with the foundations. It held 175 million gallons, so that the cost was equal to £1000 per million gallons—an excessive sum, inasmuch as, under ordinary circumstances, £300 per million gallons was the usual outlay. The Leeming and Leeshaw reservoirs had cost respectively £67,603 and £69,220. The compensation reservoirs held 248 million gallons. The acreage which contributed water to Thornton Moor was 1186; and that which contributed water to the two compensation reservoirs was about 1028. The Thornton Moor and Shady Bank reservoirs were authorized by the Act; but owing to the difficulties in getting a suitable foundation, the latter reservoir was not constructed. The consequence was that they had only to get the water collected in the Thornton Moor reservoir, and the compensation reservoirs were far in excess of the supply. The works had cost so much that water from Thornton Moor was sold at Bradford at less than cost. What the Court had to determine was the rent that might reasonably be expected from year to year from the works in question. The rental, he maintained, was never estimated on the structural cost, but on the structural value. The old rateable value, against which the Corporation had not appealed, was quite high enough; but the rating authorities had raised the value. No alteration had, however, been made in the works; they were no more valuable now than before. What had to be found out was the rent that might be reasonably expected from year to year from the works with which they were dealing. The Corporation did not say that the two compensation reservoirs should not be considered in fixing the rateable value; but they asked the Court to remember that they had paid the enormous sum named for them when they expected to get water from two service reservoirs. The authorities had raised the rateable value from £4072 to £6200; while the old gross had been £5429, and the present gross was £8267. He submitted that the rent to be arrived at must be rent paid for land and fixed capital which was useful for the whole undertaking. If the work had to be done again, the Corporation would show that it would not be worth doing unless they could carry it out at the reasonable amount of £300 per million gallons.

Mr. *J. Watson*, the Water Engineer to the Corporation, said that for Thornton Moor reservoir the proportionate compensation storage was 90 million gallons; and this should be provided for £50,000, against the £67,603 and £69,220 which the existing compensation reservoirs cost. In his opinion, £300 per million gallons would be the full value to a tenant; and if this amount was allowed for the works within the parish of Oxenhope, the total capital value would be £127,002. Taking the return on capital at 3½ per cent., he arrived at the gross annual value of £4445. If a fourth were taken off, the net annual value would be £3333. In his opinion, this was the whole value to a tenant of the works in Oxenhope.

Cross-examined by Mr. MARSHALL, witness said that the heavy cost of the Thornton Moor reservoir was accounted for, not because it had been built on three sides, but because the work below ground swallowed up half the total cost.

Mr. *William Terry*, the General Manager of the Sheffield Water-Works, having given evidence, estimates of the value of the works in question were submitted by two surveyors—Mr. *George Renton*, who placed the amount at £3292 12s., and Mr. *E. H. Collins*, who put it at £2780.

Mr. MARSHALL then addressed the Court on behalf of the respondents. He said the points of dispute between the parties were

very few. The real difference was as to the present structural value of the three reservoirs. The respondents' valuation, he contended, was a fair and reasonable one. Property in Keighley had been notoriously under-assessed; and a revaluation had been made in order to do justice to the ratepayers.

Mr. *Wheater Smith*, who was called by Mr. MARSHALL, said he had made a revaluation of the whole of the property in the Keighley Union. He had found that there were many inequalities which had to be redressed. His gross estimated rental of the works in question was £9773, and the net £7330. This latter sum was £1100 more than the works were actually assessed at; and this, in his judgment, was a fair way of arriving at the rateable value of the property.

In cross-examination, witness admitted that the valuation was based on the cost of the works.

Mr. *J. H. Hanson*, valuer, said he had made a joint valuation of the property with the previous witness, with whose figures he agreed.

Mr. BALFOUR BROWNE having again addressed the Court, the Magistrates retired. After a lengthy deliberation,

The CHAIRMAN stated that the Bench were of opinion that the appeal must be allowed, with costs. That was to say, the old valuation must stand—£5429 gross, and £4072 net.

Mr. MARSHALL asked for a case to be stated on the principle of the decision.

The application was granted.

Progress of the Derwent Water Scheme.

Reference has from time to time been made in the "JOURNAL" to the scheme which is being carried out by the Derwent Water Board. According to a recent report on the progress of the works, the construction of the Rowsley and Whatstandwell section of the aqueduct was commenced early in 1904, and about 520 yards of tunnel have been driven, of which 180 yards have been lined with concrete. On the "cut-and-cover" portion, 300 yards of trench have been excavated. It appears that 1350 yards of 45-inch pipes have been laid; while 1860 45-inch pipes have been delivered out of 2580 required. The masonry at the stream-crossings and the valve-houses has been completed. Building operations have been authorized by the Board on a length of foundation exposed at Derwent and approved by both their Engineer (Mr. E. Sandeman) and their Consulting Engineer (Mr. George H. Hill). The Board have also sanctioned the purchase of additional plant and machinery necessary to expedite the completion of the work. Building has proceeded at the Howden dam on foundations which have from time to time been reported to the Board as satisfactory. In order to gauge the flow of the Derwent below its junction with the Ashop, with a view to comparison with the results shown by the rain-gauges, and to furnishing information which may be useful in dealing with any claims in connection with the discharge of compensation water, the Board have authorized the Engineer to build a weir across the Derwent, just above the Yorkshire bridge.

Death of a Labourer at the Fulham Gas-Works.

Last Tuesday, Mr. C. Luxmore Drew, the Coroner for West London, held an inquiry at the Fulham Coroner's Court in regard to the death of Richard Alfred Davies (aged 45), which occurred at the Fulham Gas-Works on the previous day. Mr. A. E. W. Milroy (Messrs. Bedford, Monier-Williams, and Robinson) watched the case on behalf of the Gaslight and Coke Company. Elizabeth Sarah Davies, the widow, said her husband was a labourer, and that he had good health up to about twelve months ago, when he complained of a cold on the left lung, and said he had over-lifted himself. The doctor who was sent for said there was a strain on some of the leaders of the heart. Deceased saw the doctor a month afterwards; but the latter did not then think there was much the matter with him. Consequently witness was much surprised to hear of her husband's death. William Todd, a fitter's mate, said he had known deceased for five years, and the only thing he had heard him complain about was indigestion. While he was working on the previous day on some coal trimming, the deceased suddenly fell down insensible. Other employees having given similar evidence, Dr. John Edwards said he was called to the gas-works about one o'clock, but the deceased was then lying dead on a stretcher. He had made a *post-mortem* examination of the body, and had no hesitation in saying that the cause of death was syncope, resulting from a very bad form of heart disease. The Jury returned a verdict in accordance with the medical testimony.

The Halifax Highways Committee Wish to Instal Suction Gas.

An interesting discussion took place at the last meeting of the Halifax Town Council on a recommendation of the Highways Committee that the tender of the Campbell Gas-Engine Company, for the supply and fixing of a suction-gas plant in connection with the gas-engine at the Salterhebble sewage works, for the sum of £98, be accepted. The Chairman of the Gas Committee (Mr. J. Collinson), in moving that the minute be referred back, remarked that it was ungenerous of the Highways Committee to put down this plant at the expense of the gas-works. It would, he thought, be a great advantage if the Committees of the Corporation acted in unison with one another, instead of going into competition in this way. The amendment was seconded by Mr. Waddington, who said the best thing would be for the Gas Committee to consider the reduction of rates for gas for manufacturing purposes. There was a feeling that concessions ought to be made to users of gas for power. The Chairman of the Highways Committee (Mr. L. Shoesmith) pointed out that there was an actual saving of 49 per cent. between an ordinary 50-horse power gas-engine and a suction-gas engine. Mr. Collinson said the Gas Committee were quite awake to the fact that they might have to consider very carefully the price of gas for engine purposes and illuminating power. The competition of suction-gas plant would have to be reckoned with. If the Committee had to carry on the works with no surplus that could be taken for the rates, they would fight for their own hand as a commercial undertaking. The amendment was carried.

MISCELLANEOUS NEWS.

THE GAS SUPPLY OF PARIS.

The Arrangement with the Company's Liquidators.

In the last number of the "JOURNAL" we gave the principal items of the scheme drawn up by the Prefect of the Seine, and accepted by the Municipal Council, for continuing the supply of gas to Paris during the present year; the Gas Company's concession having terminated, as readers are aware, on the 31st ult. The following are fuller particulars of the agreement:—

The undertaking of the Company is to be carried on by the Liquidators, under the control of the City, for one year from Jan. 1, 1906. Gas is to be supplied at the price of 15 c. per cubic metre for the public lighting, and at 20 c. for private consumption. The charges for the use of meters and for the supply of fittings are to remain as at present.

The City is to receive 3·5 c. per cubic metre of gas—2 c. representing the existing *octroi* duty on the raw material, and 1·5 c. an additional allowance. The profits remaining after these deductions have been made are to be divided equally between the City and the Company.

The consumption of gas for 1906 has been reckoned at 349 million cubic metres, of which 35·8 millions will be taken by the City. In order to estimate the amounts likely to come into the Municipal Exchequer, 7·7 c. was put down as the net cost of a cubic metre of gas. This figure was arrived at as the result of an examination of the Company's accounts for the year 1904, which was in every respect a normal one. The chief items of expenditure were estimated as follows:—

	Francs.
Capital charges (additions to works)	200,000
Manufacturing charges	14,000,000
Loan charges	4,975,000
Gratuities to the *personnel*	2,800,000
Octroi duty of 2c.	6,980,700
Additional payment of 1·5c. to the City	5,235,000
Pensions	1,200,000

It was assumed that the total expenses would amount to 46,500,000 frs., and that there would be a sum of 21,562,000 frs. net profit to be divided equally between the Company and the City. Adding to the City's moiety the sum already allocated to the Exchequer, it was concluded that a revenue of 22,995,000 frs. might be put into the budget for the present year as derivable from the gas undertaking. In the event of some unforeseen occurrence—such as a rise in the price of coal and a fall in the value of residuals—the net cost per cubic metre of gas would be 9 c., and then the amount coming to the City would be 20,727,000 frs.

The employees in the undertaking have been placed on the same basis as those in the service of the Municipality.

MANCHESTER GAS, ELECTRICITY, AND WATER SUPPLY.

Income-Tax on Gas Profits—Nuisance Caused by Electrical Machinery—Increase in the Water-Rates.

At the Meeting of the Manchester City Council last Wednesday, the Gas Committee presented a report on the question of the income-tax on the gas profits. It set forth that the Superintendent (Mr. Charles Nickson) had reported that a claim had been made, under section 12 of the Customs and Inland Revenue Act, 1878, in respect of the sum of £16,363, being the difference between the actual cost of the renewals of machinery and plant, and the estimated cost of such renewals on a depreciation basis; but the claim had been disallowed by the Surveyor of Taxes. An appeal was then made to the Commissioners of Taxes, and was heard by them on the 6th ult.; and they eventually confirmed the decision of the Surveyor. In order to give the Corporation *locus standi* in the Courts, the Commissioners had been asked to state a case. Having regard to the cost of appeal and the doubtful issue, the Superintendent did not think it desirable to proceed further this year; but he recommended that, in order to meet one of the objections of the Commissioners, the Accountant should be authorized to open a renewals suspense account. It was resolved that the appeal should not be proceeded with, but that the Chairman and Deputy-Chairman of the Committee should be authorized to make such alterations in the annual financial statement, by the suggested establishment of a renewals suspense account, as they might consider necessary.

The Electricity Committee reported their desire to settle the action brought against the Corporation by Mr. J. Emmott Barlow, by the acquisition, on the basis of compulsory purchase, of a warehouse belonging to him, which is effected by vibration of machinery in the Dickinson Street generating-station. It was explained by the Chairman (Mr. George Howarth) that the Committee had had to pay Mr. Barlow £1000 per annum reckoned from March, 1899, in order to keep the case from going into Court again. Now the time was nearly up; and unless terms were arranged, he could force them again into Court at the Hilary Term. They had been unable to prevent the vibration to the extent that they had wished; and rather than face the heavy damages which the Court would be likely to inflict, they decided to adopt the course suggested. Mr. Howarth also explained, in reply to a question, that in the Midwood case,* though Counsel had advised an appeal to the House of Lords, the Committee felt that there was little chance of altering the view of the Court as to the negligence of the Corporation's servants; and in such circumstances they thought the cost of going to the Lords was more than they were warranted in incurring. The Committee's proceedings were approved.

* This case was noticed in the "Electric Lighting Memoranda" in the "JOURNAL" for the 18th of July last.

The Chairman of the Water Committee (Alderman Sir Bosdin Leech) moved that the public water-rate be raised from 1d. to 2d. on the rateable value in the City; that 1d. be added to the domestic water-rental outside the City; and that discount on all meter accounts be disallowed. He explained that a few years ago the Committee made a greater reduction in the water-rates than they were justified in doing, because the members anticipated that coming years would easily recoup the deficiency. Instead of £10,000 a year advance in revenue, there was a drop of £2000. The present advance would be remitted as soon as this could be done prudently. Mr. Johnston moved an amendment to refer the subject back for further details. He said some people were obtaining water at 5d. per 1000 gallons, which was below its cost to the Corporation, and too low a price to be charged. Sir Bosdin Leech said the man who paid 5s. for water for his home did not pay cost price, but the City reaped the value in a sanitary way. The cheapness of water attracted manufacturers, and caused them to build works which brought many people to become householders and ratepayers, and in many ways to add to the revenue of the City. Alderman Holt said it should not be forgotten that water could be procured by boring at a cheaper rate than that at which it could be supplied by the Corporation. The water was in the reservoirs, and if it was not used for various purposes, including manufactures, it went to waste. The amendment was lost, and the recommendations of the Committee were adopted.

OPPOSITION TO THE DERBY GAS BILL.

At last week's Meeting of the Derby Town Council, the Parliamentary Committee reported that they had had under consideration the provisions of the Derby Gas Bill, 1906. In 1903, the Corporation petitioned against a Bill promoted by the Company; and among other provisions objected to was a clause which would have affected the right enjoyed by the Corporation since 1852 of being supplied with gas for the public lamps at the lowest price charged to private consumers. The petition was subsequently withdrawn; a compromise having been effected with the Company, one of the terms of which was that this clause should be struck out. Notwithstanding this, a similar clause had been inserted in the Bill now deposited; and the Company proposed therefore to deprive the Corporation of part of the benefit the latter derived under the compromise, while retaining the whole of the benefits the Company secured thereby. There were other provisions in the Bill which, in the opinion of the Committee, were likely to be prejudicial to the Corporation; and they therefore recommended the Council to pass a resolution to petition against the Bill.

The report of the Committee was adopted; and thereafter the following resolution was moved by Mr. Russell, and duly seconded: "That a petition be presented against the Derby Gas Bill, 1906; that the common seal be affixed thereto; and that the Parliamentary and General Purposes Committee be empowered to take all steps necessary for preserving the interests of the Corporation." Alderman Hart said he did not think it desirable that any expert witnesses should be secured until the Committee had tried all means possible of avoiding having to call them. Mr. Russell assured the Council that the Committee had not the slightest desire to injure the Gas Company in any way whatever. They merely wished to maintain the rights possessed by the Corporation. A Sub-Committee had been appointed; and the Council might be certain that not a penny would be spent until every means had been tried to bring the matter to a satisfactory close. Mr. Newbold pointed out that what the Council wished was that gas should be supplied them at the lowest price charged to any consumer. Whether this was a reasonable request or not, it was desirable for the Committee and the Gas Company to come to some agreement if they possibly could. He would further like to point out that the Electric Light Committee supplied power at 1¼d., and light at 4½d. per unit. He trusted the Committee would think the matter over carefully before they rushed into law. Mr. Shackleton said the gas now supplied was very unsatisfactory, and had not the illuminating power it possessed years ago. Mr. Russell replied that he did not see the use of discussing that day the alleged impurity of the gas; the Sub-Committee ought to deal with this matter, and report to the Council if there was any difficulty. The resolution was carried.

COVENTRY CORPORATION AND ELECTRICITY SUPPLY.

Gas v. Electric Power.

At the Meeting of the Coventry Corporation last Tuesday, an attempt was made by the Vice-Chairman of the Electric Light Committee (Mr. Errington) to obtain some definite information in regard to the supply of current for the production of light and power by the Committee. It took the form of a double-barrelled motion, in the following terms: "(1) That a return be presented to the Council with respect to the motors let on hire by the Electric Light Department, giving, for each year during which the motors have been let on hire, the following information: The amount of capital expenditure, the amount paid in interest and sinking fund, the amount expended in maintenance, the net profit, and the amount of income derived from the motors used by each of the following trades: Cycle, engineering, motor, watch, textile, printing, miscellaneous. (2) That a return be presented to the Council giving, for each year since the electric light undertaking has been inaugurated, the following information: The income derived from private lighting, the income derived from the lighting of Corporation buildings, and the income derived from the lighting of street-lamps." The motion gave rise to a debate which revealed unquestionable dissatisfaction among the members at the way in which the business of the Committee was carried on, and the difficulty of getting any information. It is unnecessary to follow the various speakers; but the remarks of one—

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Mr. Snape—should certainly be recorded. In supporting the motion, he related the experience of a man who had been induced to put down an electric motor in place of a gas-engine. The manager of the electric light works advised the installation of a motor of high power, and said it would work out, after taking into consideration repairs to the gas-engine, &c., at the same price. A motor was accordingly put in at a cost of £14 to the customer, besides which the department had to incur considerable expense in carrying the main about 150 yards; and at the end of 20 weeks it was found that the cost of the motor was nearly double that of the gas-engine. It was then given a 48 hours' continuous run, and the cost of the energy worked out at £5 0s. 11d.; while that of the gas-engine, for an equal period, was £3 14s. 8d., exclusive of 2s. for water for cooling—a difference of £1 4s. 3d. Mr. Snape added that it appeared to him that great accuracy was required before people were persuaded to put in motors. The consequence might be that the Committee would be left with a lot of them upon their hands if this sort of thing went on. Mr. Errington's attack upon the Committee received the sympathy of the Council in a very marked degree; and when his motion was put there was apparently only one dissentient vote—Alderman West's, the Chairman of the Committee.

GAS-ENGINES IN SCOTLAND.

The "Glasgow Herald" is in the habit of publishing at the end of every year a supplement containing a very full and exceedingly well-written narrative of the shipbuilding, engineering, commerce, &c., of the twelve months. In the one issued a week ago, there are three different references to gas-engines. These somewhat overlap; but, leaving out where they do so, the statements are of so much interest and weight that they are worth giving.

In the first, under the heading of "New Marine Motors," the opinion of Sir William White regarding the explosion engine is quoted, and then it proceeds: "More than one engineer is looking towards the gas-motor as the germ of the engine of the future. Already Messrs. Thornycroft have turned out a gas-motor boat, which has run trials at Southampton. The problem, however, is now being tackled in a more practical manner. Messrs. William Beardmore and Co., of Dalmuir, have the British rights of the Capitane gas-engine, one of the simplest and most popular of Continental designs; and they are re-engining Messrs. J. Hay and Sons' small steamer *The Earl*, substituting for the boiler and reciprocating engine a Capitane gas-engine intended to develop 600 brake-horse-power. The result of this experiment will be looked forward to with great interest. Various other ideas for obtaining power in new ways have been ventilated during the year; but these are the only two that seem as yet within the range of practical engineering."

Then, under a description of the work which has been done at Messrs. Beardmore and Co.'s place, it is said: "During the year two 400 brake-horse-power engines (gas) for direct driving of air compressors have been erected at Dalmuir; one 2000 brake-horse-power is now in course of erection there for generating electricity; one 500 brake-horse-power is ready for erection for the extension of compressed air-plant, and one 1000 brake-horse-power is in course of erection for generating electricity; and one 500 brake-horse-power is also in course of erection. These Oechelhaeuser engines have proved a great success at the Company's Dalmuir works, where the whole power is provided by them for the shipyard and engine works. At Parkhead, one 500 brake-horse-power is driving a sheet-rolling mill, and working constantly day and night on producer gas."

The third notice is under the heading of "General Machinery," and states that: "It has come to be recognized that the gas-engine is making rapid strides, and has become a serious rival to the steam-engine. Much of the progress, however, which has been made in the larger sizes of gas-engines in recent years has had to be placed to the credit of Continental engineers; British manufacturers having been content in many instances to accept Continental designs, and build under licences from Continental engineers. Under these circumstances, it is satisfactory to learn of an "all British" engine, such as is being manufactured by Messrs. A. Rodger and Co., to the designs and under the patents granted to Emeritus-Professor Rowden, of Anderson's College, Glasgow. These engines are of the inverted vertical type; and in this respect they correspond to the most successful types of steam-engines for central station and marine work. There are many points in the design of this most interesting engine which appeal to the engineer, but which are difficult to describe in a simple manner. These engines have been designed for the use of producer gas, either for pressure or suction-gas plants; and the results of the various tests up to date have, it is claimed, shown the engine to be not only economical, but thoroughly reliable. The first engine made by Messrs. A. Rodger and Co. was installed at their engine works at Govan, and has driven their works for over two years. A large installation of these engines has been ordered for the new "Argyle" Motor Works, at Alexandria. In all, ten engines of 100 brake-horse-power each will be supplied under this contract. Six of these engines are now in position."

BILSTON GAS COMPANY.

The Annual General Meeting of this Company was held on Monday last week—Mr. H. Holcroft in the chair.

The Secretary and Manager (Mr. J. S. Reeves) having read the notice convening the meeting, the report and accounts for the year ending the 30th of September were presented. After paying the usual interim dividends, there was a balance of £5292 on the profit and loss account; and it was proposed to pay further dividends of 5s. 6d. and

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4s. per share on the "A" and "B" shares respectively, making 11s. and 8s. per share for the year, and to carry forward the balance of £2607.

The CHAIRMAN, in moving the adoption of the report, said he thought it would be agreed that the position of the Company, as shown by the accounts, was satisfactory. So far as rates and taxes and the price of coal were concerned, he was afraid they would get little relief in these directions; but he was of opinion that as soon as the trade of the district recovered from the wave of depression now prevailing, the sales of gas would improve. They paid nearly £1800 in rates and taxes, which was equivalent roughly to 3½d. per 1000 cubic feet of gas. That was to say, a consumer, in addition to paying his own taxes, was indirectly rated to the extent of 3½d. upon every 1000 cubic feet of gas he burnt. They could tell, by the rigid economy which consumers were exercising, that the trade depression had not yet passed. There had been improvement in one or two trades; and when things were generally better, they could hope for a larger consumption of gas. Competition for lighting and power had stimulated a healthy rivalry among companies; and he thought he could assure the shareholders that they were in a good position to meet all comers. They were not able to compete for large power engines, but they could do so for small ones; and at the price at which they were now selling gas, he thought he was correct in stating that independent and qualified engineers were of opinion there was no cheaper or more convenient power than gas.

Mr. THOMSON seconded the motion, and it was carried.

The dividends recommended were declared, the retiring Directors and Auditors were re-elected, and votes of thanks were passed to the Directors and officials, as well as to the Chairman for presiding.

SOME LOCAL GOVERNMENT BOARD DECISIONS.

The current number of the "Local Government Journal" contains some extracts from the first quarterly collection of "Departmental Decisions" for the past year, which is issued from the same office. The following refer to matters connected with the supply of gas and water on which the Board have expressed opinions.

The Board's practice has always been to require plans, estimates, &c., to be submitted whenever it is proposed by local authorities to borrow money. But there are many instances in which capital expenditure on a particular purpose is of a continuous character (such as the laying of gas and water mains to keep pace with a growing district); and under such circumstances, it is difficult to furnish plans and full particulars. To meet these cases, the Board have expressed their readiness to consider applications for sanction to loans for prospective expenditure without requiring details beforehand. The loan may be of such an amount as will be sufficient to defray anticipated expenditure on a particular purpose during an ensuing period of not more than three years.

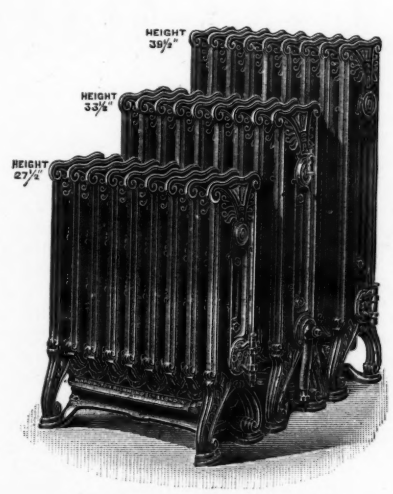
A district council would have no power to carry on a gas undertaking without parliamentary authority such as could be conferred upon them by a Provisional Order under the Gas and Water Works Facilities Acts. Further, section 162 of the Public Health Act, 1875, only authorizes the acquisition of a gas undertaking by an urban authority for the purpose of supplying gas within their own district. This section would not suffice, therefore, to authorize the purchase by an urban district council of the whole of a company's rights, seeing that these include the right to supply gas in areas outside the urban district. Neither could a Provisional Order under the Gas and Water Works Facilities Acts authorize an urban district council to supply gas beyond the limits of their district; and the Board would only be prepared to entertain an application for such an Order and for sanction under section 162 of the Public Health Act, 1875, if the purchase were restricted to the company's rights, &c., within the urban district.

The Public Health Acts only allow local authorities to borrow money for permanent works, though it is left to the Local Government Board to construe the term in any particular case. A question arose as to how the Department would deal with an application for sanction to a loan for the sinking of a well which might or might not result in the provision of a supply of water. In response to a proposal of this kind, they expressed willingness to consider the scheme with a view to sanction, but stated that the term allowed for the repayment of the loan would be five years only. If, however, the works were successful, they would be prepared to sanction a reborrowing for a more extended period.

NEW PUMPING-STATION AT BRIGHTON.

In the "JOURNAL" last week, reference was made to the recent opening of a new pumping-station, costing £88,000, in connection with the water supply of Brighton. From further particulars which have reached us, it appears that the site, comprising about 4 acres of land, together with two pieces, each about an acre in extent, situated on the Downs, was purchased from the Earl of Chichester in August, 1900. The contract for sinking the wells was let in September, 1901, and work was immediately commenced. The underground works at present consist of two oval wells, 14 ft. by 10 ft., and 214 feet deep, connected by two cross headings; one winding shaft, 6 feet in diameter and 185 feet deep; and 1582 feet of headings, 6 ft. 6 in. by 5 ft. 6 in., with grip along one side 2 feet wide and 6 feet deep. There is also in front of the engine-house an underground covered reservoir capable of holding about 600,000 gallons.

The pumping machinery is in duplicate, and consists of two sets of marine type vertical direct-acting triple-expansion engines, working on three cranks. Each engine is placed directly over three plunger



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Efficiency in action.

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pumps; and the crank-shaft is prolonged at one end so as to carry the fly-wheel and drive a set of three-throw deep-well pumps, the other end being prolonged so as to carry a disc for working the air and feed pumps. The deep-well pumps lift the water from the wells and discharge it into the underground reservoir, whence part of it flows by gravity into the low-service reservoirs behind the Lewes Road works, and the rest is taken by the plunger pumps and delivered into the high-service reservoirs in Brighton. Each engine is capable of lifting and delivering 5 million gallons of water in 24 hours. The steam is supplied by five Lancashire boilers, each 30 feet long and 7 ft. 6 in. diameter, with a working pressure of 160 lbs. per square inch. In the south-west corner of the engine-room there is an electrical water-level indicator and recorder, which shows the varying level of the water in the underground reservoir.

The engine-room is 99 feet long, 34 feet wide, and 32 feet high to the eaves. At the north end there is an office set apart for the use of members of the Water Committee and the foreman, and at the other end is a workshop. Beneath the engine-room is the basement where the plunger pumps, air and feed pumps, condensers, and various valves and pipes belonging to the machinery are situated; and at either end is a store-room. Entrance to each of the wells is gained from this basement; and access to the pumps for examination and repairs, as well as to the underground workings, is obtained by ladders in the wells. The boiler-house is 89 feet long and 50 feet wide. At the south end is a fuel economizer, and in the north-east corner a small vertical engine, which works a capstan for hauling the coal-waggons from the siding on to the top of the coal-store, which immediately adjoins the boiler-house. The store will hold when full about 800 tons. It is furnished with a system of turn-tables and tramlines, which run into the boiler-house, and the coal is conveyed in small waggons over these lines right to the front of the boilers. A few yards south of the boiler-house is the chimney-stack, 140 feet high. From the Falmer Station a railway siding has been constructed, which runs right up to the coal-store wall, and by a system of turntables the coal-waggons can be run on to the top, in which there are holes to allow of the coal being emptied direct from the waggons. There is a 20-ton waggon weigh-bridge on the siding for checking the weight of the coal. A residence has been erected at the south-west corner of the pumping-station for the foreman in charge of the works.

TYNEMOUTH WATER-WORKS EXTENSIONS.

Claim for Compensation.

At the Moot Hall, Newcastle, last Wednesday, Mr. BRODERICK THOMPSON (the Under-Sheriff), sat with a Jury to assess the amount to be paid by the Tynemouth Corporation to the Executors of Lord Hastings in respect of an easement which the Corporation claimed through his Lordship's land in connection with works under their 1898 Water Act. The Corporation desired an easement, or right in perpetuity, for the purpose of laying a gravitation main, or a line or lines of pipes, authorized by the Act; and the question was as to the price to be paid for the easement, and as to the compensation to be paid for the damage caused by the execution of the works.

Mr. G. THORNE DRURY appeared for the Corporation; Mr. R. B. D. ACLAND, K.C., and Mr. R. O. BIRCHAM represented the Executors.

The Corporation required an easement 21 feet broad, through Lord Hastings's Seaton Delaval Estate; and it was submitted, on behalf of his Executors, that a foreign owner going through an estate was a detriment. For the Corporation, it was suggested that the pipe was 4 feet deep; that the surface had been restored; and that the tenant of the land disturbed had been compensated. Where the land was agricultural, there was nothing whatever to prevent the ordiary operations of agriculture. Where it was pasture, in two or three years the grass would have grown again, and the track would be quite indistinguishable. The proper basis of compensation, it was suggested, was the lessened letting value of the land to the landlord.

The following evidence was then given:—

Mr. *Clark* said the effect of a pipe going through the middle of the land, and the presence of an alien owner, was to deteriorate the land. If he were valuing the land, he would give £1086 10s. 2d. more for it if the pipe-line was not there. It was quite possible the landlord would get a lower rent because of the presence of the line; such a line being a nuisance.

Mr. *W. Forster* said he generally found that where a line had been laid, a beaten track resulted. Land 21 feet wide he should value at 30 years' purchase; but with a pipe he would value it at two or three years' purchase less. The agricultural land he put at 6d. per lineal yard; and it was agreed that there were 1138 lineal yards.

Mr. *Potts* gave evidence as to the value of the building land, which he put at £1044.

Mr. *Percy Stevens* agreed with what had been said as to the depreciation caused by such a pipe-line as the one in question. As to the agricultural land, he put it at 6d. a yard for 1138 yards; and this came to £28 9s. There were three manholes, at 10s. each—30s. A spoil-heap came to 18s.; and the total was £30 17s. Capitalized at 30 years' purchase, this came to £925 10s.; and adding 10 per cent. for compulsory purchase, the wash-out chamber, &c., brought up the total to £1084 18s. 3d.

Mr. *R. Askwith*, called on behalf of the Corporation, said the land through which the line of pipes in question was laid was at present agricultural land only worth about 25s. an acre. The surface had been restored, and in some places it was impossible to distinguish it from the rest of the land. Being connected with a water undertaking, he had had considerable experience in arranging the value of land through which pipe-lines had been laid; and he put the price in the present case at 1d. per yard, with an extra 0·1d. for compulsory purchase. This, on 1580 yards, came to £7 4s. 10d. He put nothing

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
Blackburn	1,250,000	St. Catherines (Remodelled)	250,000	Tonbridge	300,000
Windsor St. Works, Birmingham	2,000,000	Kingston, Pa.	125,000	Stretford	500,000
Saltley Works, Birmingham	2,000,000	Peterborough, Ont.	250,000	Oldbury	300,000
Colchester	300,000	Wilkesbarre, Pa.	750,000	Todmorden	500,000
Birkenhead	2,250,000	St. Catherines (Second Cont.)	250,000	Saltley, Birmingham (Third Contract)	2,000,000
Swindon (New Swindon Gas Co.)	120,000	Buffalo, N.Y.	2,000,000	York (Second Contract)	750,000
Saltley, Birmingham (Second Contract)	2,000,000	Winnipeg, Man.	500,000	Rochester (Second Contract)	500,000
Windsor St., Birmingham (Second Contract)	2,000,000	Colchester (Second Contract)	300,000	Newport (Mon.)	250,000
Halifax	1,000,000	York	750,000	Tokio, Japan	1,000,000
Toronto	250,000	Rochester	500,000	Pernambuco, Brazil	125,000
Ottawa	250,000	Kingston, Ont.	300,000	Malton	150,000
Lindsay (Remodelled)	125,000	Crystal Palace District	2,000,000	Duluth, Minn. (Second Cont.)	300,000
Montreal	500,000	Duluth, Minn.	300,000	Brockville, Ont.	250,000
Toronto (Second Contract, Remodelled)	2,000,000	Caterham	150,000	Smethwick	500,000
Belleville	250,000	Leicester	2,000,000	Gravesend	300,000
Ottawa (Second Contract)	250,000	Enschede, Holland	150,000	Newport (Mon.) (Second Cont.)	250,000
Brantford (Remodelled)	200,000	Buenos Ayres (River Plate Co.)	700,000	Toronto (Third Contract)	750,000
		Burnley	1,500,000	Toronto (Fourth Contract)	1,000,000
		Kingston-on-Thames	1,750,000	Montreal, Ont. (Second Cont.)	1,800,000
		Accrington	500,000	Hamilton, Ont.	400,000

Leeds, 1,800,000 C. Ft. Leicester (Second Contract), 1,000,000 C. Ft. Newcastle-on-Tyne, 1,800,000 C. Ft.

And, in addition, 8,150,000 Cubic Feet daily; also Coal-Gas Plants at Nelson, B.C., Chatham, Berlin, Napanee, Owen Sound, Calgary, and Winnipeg.

down for manholes, because they did no harm. For the wash-out pipe he put 3s. 2d., and for the spoil-heap, 4s. 1d. He had put down something for the loss in the building site—15s. a year. These figures together made £8 7s. 1d.; and this at 30 years' purchase worked out at £250 12s. 6d.

In cross-examination, witness said the land had some prospective value as building land; but the prospect was very remote. He explained how it was that the grass grew better over water-pipes than round about them. The water that came through the pipes from the reservoirs was warmer at certain seasons than the land through which the pipes run. The most they had ever paid was 2·18d. a yard; and that was a case in which they paid under pressure. In the present instance, with a limited number of houses, and an unlimited quantity of land, the only loss to the landowner was the agricultural value, because if he did not sell one site he sold another adjoining it, if the land was wanted.

Mr. *R. J. Aynsley* said the land was agricultural, and was worth, on an average, 23s. an acre. He put the payment to the landowner at 1d. per yard, which was the amount he had paid and received in other cases. He calculated the total amount, including pipes, wash-out, manholes, and spoil-heap, at 30 years' purchase, at £230 7s. 6d., *plus* 10 per cent. for compulsory purchase; making in all £253 8s. 3d.

Mr. *J. W. Wilkinson*, the Chairman of the Hexham Assessment Committee, said he had never heard of a case in which a tenant had had a reduction of a penny of rent in consequence of a pipe-line. He thought 1d. a yard was sufficient compensation, as the land was not building land.

Mr. *T. Hudson* said the prospect of building was so very remote that the land had no potential value for this purpose. He would like to have a pipe-line passing through his land, because the compensation he would receive would pay him better than the original land. It was also of benefit to the landlord, who got double the agricultural value of the land, without the surface being taken away from him.

Other evidence was given, to the effect that the easement would not injuriously affect the value of the land, and that 1d. a yard was a fair amount for compensation.

The Jury awarded £500 as the compensation for the whole length of pipe, including all the items.

Incandescent Gas Lighting for Wellingborough.—Some weeks ago, the Wellingborough District Council had before them proposals from the Electric Light Company and the Gas Company for the public lighting of the town. The latter suggested that a decision should be deferred until the Council had had an opportunity of seeing the kind of lighting the Company were prepared to offer; and they expressed their willingness to fit some of the existing lamps with incandescent burners and maintain them for a few weeks. The effect has been to lead the Council to decide in favour of gas; and this illuminant will be in general use for the public lighting in a very short time.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

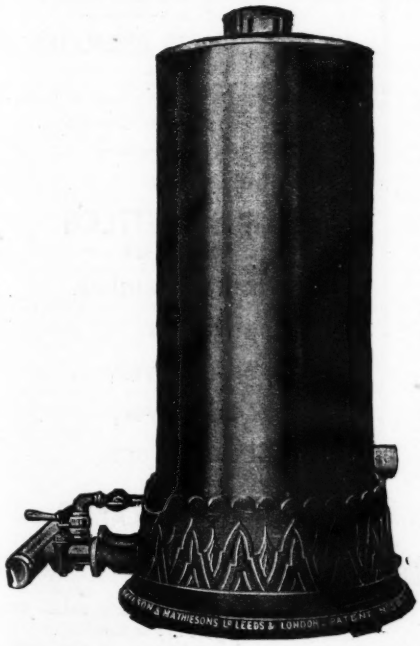
I have received from Mr. R. S. Carlow, of Perth, the Secretary and Treasurer to the North British Association of Gas Managers, the official report of the proceedings at the annual meeting of the Association in St. Andrews last July. The technical part of the work, which is in the hands of a professional gentleman, requires no comment, as it is simply perfect. But there is much work besides that, which devolves upon the Secretary; and it is altogether fitting that his great labours on behalf of the Association should be acknowledged. There is a great deal of work involved, for instance, in the getting together of the information contained in the Statistical Report of the Gas Supply of Scotland—probably not so much on account of the work which has to be got through, as of the necessity there is for waiting upon the slowest man to send in his figures, and the consequent interruption to the work; and I am sure Mr. Carlow deserves consideration in this respect I find that the number of gas undertakings in Scotland is 245, and that there are particulars given of 215; leaving 30 which make no return. Considering that the movement is an entirely voluntary one, the result is very gratifying.

Early in the morning of Saturday last, an explosion of gas took place in a dwelling-house on the ground flat at No. 6, Brooklyn Place, Govan. The house was occupied by Donald Campbell and his daughter. About one o'clock in the morning, Miss Campbell awoke, and perceiving a strong smell of gas, she aroused her father. He procured a light and began to search for the escape. When he entered the bathroom there was an explosion which is described as terrific. Windows were blown out, doors were nearly wrenched off their hinges, and a partition wall was damaged. Both Mr. Campbell and his daughter were severely burned. Miss Campbell, though suffering great pain, made her way to the street, where she found a constable, who procured medical assistance, and the fire brigade; but the services of the latter were not required, as what flames there were were extinguished before their arrival. After having temporary dressings applied, the injured persons were sent to the Western Infirmary. The cause of the escape of gas was found to be the accidental turning on of a cock upon a disused gas-pipe.

In response to the extension of coal mining in the Lothians, the small town of Tranent, in Haddingtonshire, is in the process of enlarging its borders. An increasing demand for gas is the accompaniment of this movement, with the result that the Tranent Gaslight Company have found it necessary to make increased provision for the supply. A property in the immediate vicinity of the gas-works was acquired, and upon the site a new gasholder, of a capacity of 14,000 cubic feet, has been erected. This brings the storage capacity up to 21,000 cubic feet, which, it is believed, will be sufficient to meet the requirements of the district for many years to come. The maximum

HOT WATER THROUGHOUT THE HOUSE DURING THE SUMMER WITHOUT LIGHTING THE COAL FIRE BY THE WILSON

"CIRCULATOR" WATER HEATER.



This Heater is to be attached to the water pipes between the Kitchen Boiler and the Hot Water Cistern or Cylinder, and can be fixed in any convenient position in the Kitchen, Bathroom, &c., so that it is below the Cistern or Cylinder, and the result of its use is to heat the water in the Cistern or Cylinder by circulation the same as the coal fire; it does not interfere with the use of the coal fire boiler; either can be used separately, or both together if an extra quantity of hot water is required.

The advantages of the "Circulator" are—hot water can be obtained in **Hot Weather** without the coal fire, and in **Cold Weather**, by leaving the smaller burner alight during night when the fire has gone out, hot water is available in the early morning.

In ordinary use during hot weather about 100 feet of gas (costing from 2½d. to 4d., according to price of gas) will give 50 gallons of hot water, and we suggest that the smaller burner, consuming about 10 feet per hour be used for 10 hours each day.

It is constructed throughout of strong copper, tinned inside with pure tin. The cast-iron stand is fitted with a double concentric burner, the larger one to be used to heat the water quickly, and the smaller one for use during the day to maintain the constant supply of hot water.

Size of the "Circulator" over all—**9** inches diameter, **20** inches high to top of socket. The brass sockets are for ¾-inch iron pipe.

PRICE complete (as engraved) with Stand, Double Concentric Burner, and Tray,
£4 10s. 0d.

WILSONS & MATHIESONS, LTD., LEEDS & LONDON.

daily output rose in the course of the past year from 15,000 to 16,000 cubic feet; so it will be apparent that, so far as storage is concerned, there is ample reserve in the works.

The output of gas at Pitlochry, where the gas-works are almost new, continues to be satisfactory. During 1905 it amounted to 4,332,000 cubic feet, as compared with 3,827,000 cubic feet in 1904. The increase is mainly attributed to the use of gas cooking-stoves, of which there are a number fixed with prepayment meters.

Inverkeithing is the town which is in immediate proximity to the projected Naval operations in the Firth of Forth, and as such has a future before it which some of the numerous ancient burghs in Fife may well envy. There is, as yet, little indication of the coming wave of prosperity; yet it was reported at the annual meeting of the Gas-light Company the other day that there had been a satisfactory output of gas during the year, and that there had been unusual expenditure in the laying of mains and otherwise. A dividend at the rate of 5s. per share, free of income-tax, was declared.

CURRENT SALES OF GAS PRODUCTS.

Week ending Jan. 6.

The London market for tar products remains steady; and a fair amount of business is being done. With respect to pitch, considerable shipments are being made, and inquiries are on hand for large quantities, both for fuel and road-making purposes. The efforts of dealers to depress prices in order to cover pitch sales are not likely to be very successful in this market, as the true position of the article does not warrant a reduction in value. Makers quote 35s. Benzol, 90 per cent., has again realized 10½d. net, and 90 per cent. toluol 1s. net for early delivery. Sulphate of ammonia is distinctly better; and the price for Jan.-Feb., on Beckton terms, is £12 16s. 3d. per ton, and a premium is required for March to April delivery.

LIVERPOOL, *Jan.* 6.

Sulphate of Ammonia.

Makers having cleared their stores as far as possible in December, supplies have been less abundant; and a better demand having developed during the week, values have improved all round. The closing quotations are £12 7s. 6d. per ton f.o.b. Hull, £12 10s. to £12 11s. 3d. per ton f.o.b. Liverpool, and £12 12s. 6d. per ton f.o.b. Leith. There has also been good inquiry for delivery over the Spring months, and some buying at £12 12s. 6d. to £12 15s. per ton, but this has been mainly for covering purposes; direct buyers being unwilling to pay any substantial premium on recent spot prices. At the close, makers seemed rather inclined to wait further developments.

Nitrate of Soda.

This article is firm, but spot prices remain 10s. 9d. to 11s. per cwt., according to quality.

LONDON, *Jan.* 6.

Tar Products.

There has not been very much doing during the past week, and markets have been generally quiet. Crude carbolic still continues in good demand, and business has been done in 60's at 1s. 9½d. for January-March; but for January-June manufacturers will not accept less than 1s. 10d. Crystals are in rather better demand, but there does not appear to be much actual business doing, and prices remain stationary. In 90 per cent. benzol, there is certainly more offering, especially for January-March delivery. London makers are reported to be willing to accept 10d., though, as a rule, they quote 10½d. Small sales are reported in toluol at 1s. per gallon for prompt; but there is very little offering either in London or the Provinces. Creosote is quieter in the London market, and there is more desire to sell for forward delivery. A fairly large quantity is reported to have been offered at 1⅜d. for January-March without finding buyers; but in Yorkshire and the Midlands, there is still a strong demand, especially for forward delivery. In solvent naphtha the market remains firm; and as there are practically no stocks prices are not at all likely to be easier for some time to come. The demand for home consumption is especially good, and considerable quantities of 95 per cent. at 160° have been taken for prompt delivery. The market in pitch is very quiet indeed. There are, however, buyers in London at from 32s. to 32s. 6d. But makers do not seem at all anxious to sell just at the moment, and prefer waiting a little rather than reduce their quotations. In the Yorkshire district, a little business has been done at from 31s. to 31s. 6d. for early delivery; while in Lancashire, sales are reported at 30s. 6d. for prompt shipment. There is still a very good inquiry from South Wales for February-June delivery; and consumers appear likely to require fairly large quantities over this period. The prices they offer, however, are decidedly under those which manufacturers are prepared to accept, though it is reported that at the close of the week one or two contracts have been arranged in Swansea and Cardiff at rather lower prices than those ruling a little while ago. There is really nothing whatever doing in anthracene.

Average values during the week were: Tar, 18s. to 22s.; Pitch, London, 32s. 6d. to 32s. 9d.; east coast, 31s. to 31s. 6d.; west coast, 30s. to 31s. Benzol, 90 per cent., 10d.; 50-90 per cent. 10¼d. to 10½d. Toluol, 11½d. to 1s. Crude naphtha, 4d.; solvent naphtha, 11½d. to 1s. 1d.; heavy naphtha, 11¼d. to 1s. Creosote, London, 1⅜d.; North, 1¼d. to 1⅝d. Heavy oils, 2¼d. Carbolic acid, 60 per cent., 1s. 9½d. to 1s. 9⅝d. Refined naphthalene, £4 to £8 10s.; salts, 22s. to 24s. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

The market is decidedly firmer, and there is more business doing for both prompt and forward delivery. Business has been done at £12 15s. on Beckton terms for January-March; while the South Metropolitan Company are reported to have advanced their price to £12 17s. 6d. In Hull, sales have again been made at £12 10s. for

INCLINED RETORTS.

NEW WORK 1906.

Now is the time to get Particulars of our Patent Inclined Retort-Bench, which costs about **20 per cent. less** than the old design and is equally effective. We can arrange to work it in your existing House without raising the Roof.

WRITE FOR ESTIMATES.

12 YEARS' Experience in actual building of Benches.

16 YEARS' in Manufacture of Conveyors and Elevators for same.

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Measure Chamber,
Coke Carrier,
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Coal Conveyor,
Inclined Retorts,
AND
W. T. HOLLAND'S
Grit-Proof Bearings.

No Gas-Works is complete unless the above are in use.

NEW CONVEYOR Co., LTD., SMETHWICK.

early delivery; while business is reported at £12 12s. 6d. forward. Makers are firmer in their ideas in Leith, and £12 12s. 6d. is reported to have been paid; while some of the larger makers are asking £12 15s. for January - June. In Liverpool, the demand is also stronger; and there is a good inquiry for prompt delivery.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The demand for coal for domestic and commercial requirements continues steady at late rates. Coalowners are able to satisfy all requirements without extra effort. The lull which began at Christmas is barely over. Very little new business has been done on the Manchester Coal Exchange during the last fortnight. The forces of capital and labour in the mining industry in this part of the country and the Midlands are preparing for the consultative battle to be fought out on the wages question by the Conciliation Board about the end of the month. The deliveries of gas coal and cannel are greater than at any previous period since the beginning of autumn.

Northern Coal Trade.

There has been a renewed demand for several kinds of coal; and as tonnage had accumulated at the ports, shipments have been fairly good, now that the collieries are working with something like normal fulness. Prices have been irregularly high; and a full inquiry still keeps them above the level of those before the holiday spurt. In steam coals, the demand is good for the season; and best Northumbrian steams are from 9s. 3d. to 9s. 6d. per ton f.o.b., second-class steams are about 8s. 6d., and steam smalls continue very firm at from 5s. 3d. to 5s. 9d. In the Durham coal trade, the large inquiry for coking coals has its influence on the gas and other branches of the trade. Good Durham gas coals are scarce; the large contracts taking up the bulk of the production. Prices vary, according to quality, from about 8s. 6d. to 9s. 6d. per ton f.o.b. A few cargoes have been sold forward at slight advances in the price; but no heavy contracts for gas coals are reported of late. In the coke trade, the keen demand for blast-furnace coke has an influence on gas coke; and though the output of the latter is very heavy, prices in some cases seem firmer. For export, about 11s. per ton f.o.b. has been quoted at Newcastle for good gas coke.

Scotch Coal Trade.

Trade had no official sanction last week, so no prices are available. The figures as to shipping for the week were 286,544 tons—a decrease of 32,832 tons upon the preceding week, but an increase of 19,279 tons upon the corresponding week of last year. For the whole of the year 1905, the quantity of coal shipped from Scotch ports amounted to 12,425,600 tons—an increase of 742,010 tons upon the quantity in 1904.

Welsh Gas and Water Proposals.

At a Meeting last Friday of the Water-Works Committee of the Cardiff Corporation—Alderman David Jones presiding—Mr. C. H. Priestley (the Water-Works Engineer) reported upon several Bills about to be promoted by South Wales Companies. In regard to the Cardiff Gas Company's Bill to extend their gas supply to several parishes to which the Cardiff Corporation send water, Mr. Priestley urged the desirability of the insertion of a protective clause to prevent the gas-pipes being laid in too close proximity to the water-pipes. He made a similar recommendation in reference to the Merthyr Gas Company's Bill. In regard to the project of the Glamorgan County Council, he said there could be little doubt that, so far as the provision of a better water supply to many of the districts in South Wales was concerned, something required to be done; and it was only by the combination of the small districts, as suggested, and the formation of Water Boards, that it was possible to deal with the problem on a satisfactory basis. It was questionable, however, whether the inclusion of a number of counties in addition to Glamorgan would better the chances of the Bill passing, especially as some of the counties had already expressed opinions unfavourable to it. The intention to make two distinct authorities—viz., the County Council itself and the South Wales Water Committee—both having practically the same powers, was certain to lead to friction between the authorities, and imperil the continuity of action so desirable in a scheme of this description. It did not appear that there would be much advantage to Cardiff in joining the South Wales Committee, the city having already fully provided for itself in the gathering-ground at Taff Fawr, which was capable of being utilized to a large extent should the population increase. At the same time, protective clauses should be inserted in any Bill, so as to make it absolutely impossible for any Committee to interfere with the Corporation gathering-grounds. The report was directed to be handed on to the Parliamentary Committee.

Improved Condition of the Leicester Water Supply.—The worst gale experienced for many months broke over the southern half of England and Wales during the early hours of Saturday morning last, and continued throughout the day. Torrential rain visited nearly every district, and it flooded the Soar Valley for more than ten miles. This has caused a great inflow into the reservoirs of the Leicester Corporation.

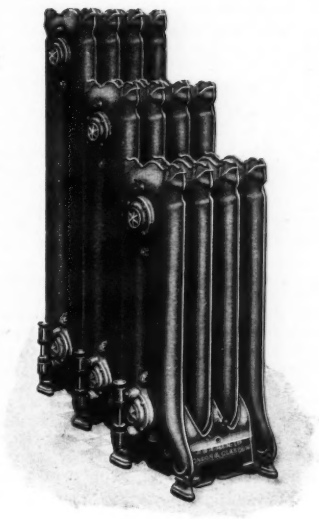
New Joint-Stock Companies.—The British Incandescent Mantle-Works, Limited, has been registered with a capital of £10,000, in £1 shares, to carry on the business of manufacturers of, and dealers in, incandescent mantles, and of all ingredients and materials used in their manufacture. The Anglo-Japanese and Oriental Corporation has been registered with a capital of £100,000, in £1 shares, to carry on, in the United Kingdom, Japan, Korea, Manchuria, Formosa, the Far East, and elsewhere, the business of financiers, concessionnaires, owners of electrical, gas, and trading rights and properties, &c. The Lewis Lighting Company, Limited, has been registered with a capital of £1507, in £1 shares, to use, manufacture, import, export, and generally trade in chemical and allied products used in connection with the production of light for streets, buildings, vehicles, &c.

THE "MAIN"

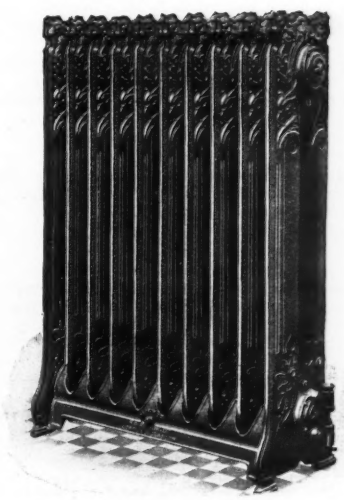
"ST. MUNGO"

Gas-heated

STEAM RADIATORS.



Plain Design.



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LONDON, GLASGOW, & FALKIRK.

Sulphate of Ammonia in the Past Year.

In the course of the report of Mr. Thomson Aikman, jun., on the progress of the chemical trade in the past year, he says, in regard to sulphate of ammonia, that the opening price was £13 to £13 5s. per ton, at which the market remained fairly steady during the early spring months; receding £12 10s. to £12 15s. per ton at the close of the first half year. With a short improvement to more than £13 in the late autumn, it remained quiet, and closed at about the lowest—viz., £12 7s. 6d. to £12 10s. per ton. The cost of the unit of nitrogen in sulphate ruled lower than that in nitrate of soda; but the moderate annual increase in production of sulphate had apparently been adequate to meet any increased demand arising therefrom. The demand for the sugar-growing colonies and from Japan absorbed a large portion of the exports from the United Kingdom; any increase in consumption in Germany and other Continental countries having been met by the increase in their home production.

An Increase of Salary for the Doncaster Gas Manager.

At the Quarterly Meeting of the Doncaster Town Council last week, there came up for consideration a recommendation of the Council in committee that the salary of the Gas Manager (Mr. R. Watson) should be raised from £350 to £400 per annum. Alderman Wainwright said that twelve months ago a motion to increase Mr. Watson's salary by £100 was defeated, though there was a general concensus of opinion in favour of an increase of £50, if a resolution to that effect had been forthcoming. The Council having morally agreed to an increase of £50 then, he was not quite prepared for the opposition that now met the resolution. He spoke in high terms of Mr. Watson's ability, and pointed out that the cost of the manufacture of gas had been gradually reduced from 1s. 2d. per 1000 cubic feet in 1902 to 1s. in 1905. The gross profits accruing from gas in 1902 were £3948, with an increase to £7669 in 1905. In other words, with extra stock, £850, the gross profits had been practically doubled. Mr. Watson was not only a gas manager, but an engineer and draughtsman. In the time of the previous Manager they had to pay £60 a year for a draughtsman. Nelson, a place no bigger than Doncaster, though there was a somewhat larger output, was offering £400 for a new manager; and Rotherham, while having a larger output but making no profit, could offer £500. After some discussion, the recommendation was put to the meeting, when thirteen members voted for the increase and eight against.

Crewe Water Supply.—In reply to an application by the Crewe Town Council, the London and North-Western Railway Company state that they do not see their way to make any reduction in the price charged by them for the town's water supply. Consideration of the matter has been deferred until the next meeting of the General Purposes Committee.

The Death by Asphyxiation at Bexhill.—At the inquiry into the circumstances attending the death of Mr. H. G. Killick Jenner, who was found in his office at Bexhill asphyxiated by gas, as recorded in the "JOURNAL" last week (p. 54), it transpired that he was at an hotel late on the previous night, and went to his office to sleep. Gas was found escaping from the stove. A verdict of "Accidental death" was returned.

Proposed Reduction in the Price of Gas at Workington.—The Workington Gas Committee are recommending the Town Council to reduce the price of gas from 2s. 6d. to 2s. 4d. per 1000 cubic feet as from April 1 next. This new price, together with revised discounts of from 2½ to 20 per cent., will bring the net charges to the four largest classes of consumers down to 2s. 2d., 1s. 11·8d., 1s. 11·1d., and 1s. 10·4d. respectively. The Gas Manager (Mr. George Keyte) gives it as his opinion that within a limited period the Council will be in a position to still further lower the price.

Gosport Water Supply.—The action of the Gosport Water Company in obtaining an entirely fresh supply from Soberton has resulted most satisfactorily, for by the completion of the sinking of the well it has been ascertained that enough water is already available to meet the requirements of the estimated increased population of 1921. This, of course, will include not only the old district at Gosport and Alverstoke, but the additional areas. The water has been found to be of a high quality, both chemically and bacteriologically. The laying of the mains has commenced, and contracts for the pumping-station are to be placed immediately.

Callao Water Supply.—A recent report by the Unlted States Consul-General at Callao states that the question of providing the town with a suitable water supply is being considered. It seems that the water supply of the port, coming from semi-artesian wells at the Puguio del Chivato, near La Legua, some 3 miles inland, while in itself wholesome enough, is contaminated at some point in its journey by the waters of the Rimac River, which bear the sewage of the adjacent city of Lima. It is proposed, in a report by the Sanitary Engineer to the Town Council, to furnish Lima with a direct sewage outlet to the sea, instead of to the river—a comparatively easy matter owing to Lima's altitude above sea-level (about 500 feet). The approximate length of the pipe-line would be about 6 miles.

Loughborough and the Leicester Water Supply.—In moving the adoption of the Water Committee's minutes by the Loughborough Town Council, Mr. Cartwright said that storage was commenced at Blackbrook on the 18th ult.; and though the rainfall during December was one of the lowest on record—being only half-an-inch at Blackbrook since storage was begun—at the present time they had the water 18 feet deep at the dam, and the quantity there that day was 25 million gallons, which was more than was stored at Nanpantan. So far as Loughborough was concerned, he could safely say that during the coming year they were in an absolutely safe position, for the borough would have a constant supply secured for the next twelve months. The water, so far as appearances went, was of the quality they always expected and obtained from Blackbrook. There was no reason now why they should not give to Leicester, when that borough was ready, some of the help it so urgently needed.

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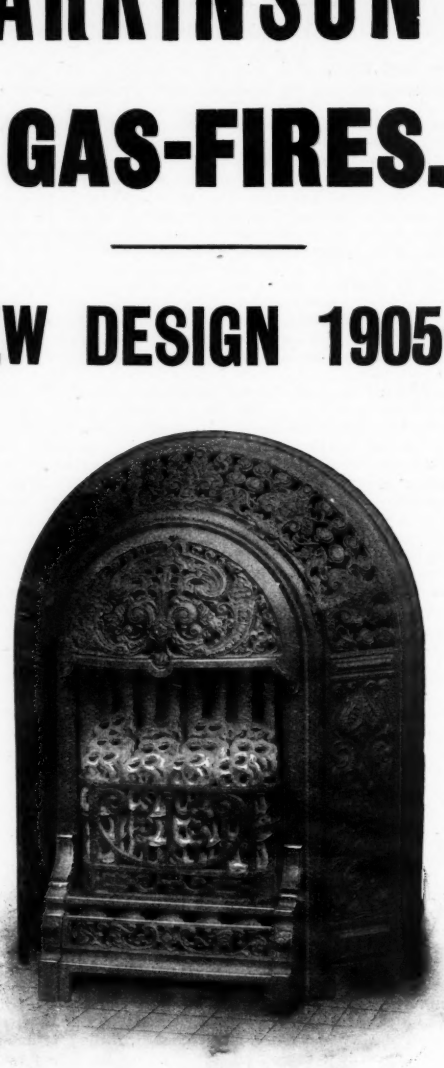

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Proposed Acquisition of the Crewkerne Water-Works.—A special meeting of the Crewkerne Urban District Council is to be called for the purpose of considering a resolution that the Council promote a Bill in Parliament at the earliest possible date for the acquisition of the undertaking of the Crewkerne Water Supply Company, and for other purposes in connection therewith.

Cost of Public Lighting in Liverpool.—The net cost of lighting the streets and passages of Liverpool during the past year is estimated at £51,808, of which £21,360 was paid for gas, and £2875 for electricity. A member has given notice that he will move at this week's Council meeting the appointment of a Special Committee to report on the advisability of purchasing the undertaking of the Gas Company.

Charge for Water at West Hartlepool.—The West Hartlepool Town Council have resolved to ask the Gas and Water Company for some rebate on their charge for water for domestic purposes. It was stated that the price was equal to 1s. 6d. in the pound on the rateable value, and was among the heaviest water-rates in the United Kingdom, notwithstanding the fact that the water had not to be conveyed any distance.

Incandescent Lighting at Stockport.—Complaints have been made in Stockport that, while some of the streets have received the benefits of incandescent gas lighting, in others the old flat-flame burners are still to be found. The General Purposes Committee, who look after the lamps, are now largely increasing the number of incandescent gas-lights; and it is their intention to carry out an inspection of the whole town in connection with this question.

Defective Electric Lighting at Colchester.—The Deputy-Mayor of Colchester (Alderman E. J. Sanders) has been finding serious fault with the electric lighting of the town. First of all, he complained of the irregularity and low voltage of the current; remarking that at his end of the town the fall in pressure had been very frequent indeed. On two occasions he telephoned to the electric light works to know why his household were obliged to requisition candles in order to read or do anything at all. On some other occasions he had asked the Manager to come up and ascertain from his own voltmeter the weakness of the current; but for reasons best known to himself he had never acceded to the request. He also complained of the defective electric lighting of the streets, and of the great nuisance caused by the belching of volumes of black smoke from the chimney at the electricity works.

The Chichester Gas Company and their Employees.—In another part of the "JOURNAL" will be found reproductions of two photographs of a holder which has lately been telescoped at the Chichester Gas-Works. It will be noticed that on the right-hand side of the second picture a building is shown in course of construction. It is a new governor, meter, and valve house; and it contains a club-room for the use of the Company's servants. The room was recently formally opened by the Chairman (Mr. Alfred Lass), and its inauguration was celebrated by a tea and social meeting, with entertainment afterwards, for the employees and their wives, preceded in the afternoon by a Christmas tree and tea party for their children. Both functions were very much appreciated by the workmen and their families; and they will doubtless tend to cement the pleasant relations existing between the men and the management, which the Directors are determined to encourage and establish.

Coal Cargoes for the Devonport Gas-Works.—As a result of the consideration recently given to the question of the discharge of coal cargoes, the Gas Committee of the Devonport Corporation have been able to effect a considerable reduction in the cost. Hitherto a charge of 3d. per ton has been made for wharfage. It has now been decided to enter into an agreement for five years with the owner of the Tamar Wharf for the landing of coal there.

It is calculated that, in consequence of the substitution of incandescent burners for the ordinary ones in the street-lamps at Cheltenham, a saving of £200 per annum will be effected.

By the Wrexham County Bench last Tuesday, two men named Jones and Brain were committed for trial on a charge of stealing 30s., the property of the Wrexham Gas Company, from a prepayment gas-meter in the Prince of Wales Inn, Coedpoeth, on the 15th ult.

The catalogues issued in 1903 and 1904 by Messrs. Gibbons Bros., Limited, of Dudley, being now out of print, the firm have issued a new illustrated list, in which all the prices have been carefully revised, and new photographs introduced showing further improvements in the design and manufacture of their band conveyors.

Messrs. Mobberley and Perry have sent us a combined blotting-pad and calendar for the current year. Each sheet of paper has printed upon it the calendar, in two groups of six months, and the name and specialities of the firm. The centre of each sheet is available for blotting purposes; and fresh sheets will be supplied on application.

The Poole Corporation have engaged Mr. William Matthews, the Water Engineer to the Southampton Corporation, to advise them in connection with their negotiations with the Poole Water Company, and their opposition to the further statutory powers the Company are seeking to obtain by Provisional Order. The engagement is, of coure, subject to the sanction of the Southampton Corporation being obtained to it.

At the Aylestone Road Gas, Chemical, and Electric Lighting Works of the Leicester Corporation, on New Year's Day, a bath chair for use in convalescent cases, which had been subscribed for by the officers and men employed at the works, was "commissioned" by being handed over by the Engineer, Mr. Alfred Colson, to a Committee of Management. For some time the need of such a carriage has been felt; and the action of the men at the gas-works in providing a specially-constructed chair is certainly praiseworthy.

An attempt is being made to get the Salford Town Council to keep a tight hand over their expenditure this year; for at the meeting last Wednesday, Alderman Phillips proposed the following motion: "That this Council, being of opinion that it is its duty strenuously to resist the growth of expenditure in excess of the proportionate increase in population and rateable value, and that any increase in the rates for the forthcoming year will be detrimental to the best interests of the borough, resolves that it be an instruction to its various Committees that, in making up their estimates of expenditure for the forthcoming year, they must keep within the amounts allowed for the current year in every case." A discussion was opened on the motion; but it had to be adjourned to the next meeting owing to there being no quorum.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 87.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct 13	10½	Alliance & Dublin 10 p.c.	21—22	+1	4 15 5
160,000	10	,,	7½	Do. 7 p.c.	14½—15½	..	4 16 9
200,000	5	Nov. 15	7	Bombay, Ltd.. . . .	6¾—7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	5—5⅛	..	5 1 10
50,000	10	Aug. 31	14	Bourne- mouth Gas and Water	10 p.c. . .	29—30	.. 4 13 4
					B 7 p.c. .	17—18	.. 3 17 9
					Pref. 6 p.c.	15½—16½	.. 3 12 9
51,810	10	,,	7				
53,200	10	,,	6				
380,000	Stk.	Aug. 16	12½	Brentford Consolidated	260—265	..	4 14 4
300,000	,,	,,	9½	Do. New . . .	197—202	..	4 14 1
50,000	,,	,,	5	Do. 5 p.c. Pref. .	125—130	..	3 16 11
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb. .	101—104	..	3 16 11
220,000	Stk.	Sept 15	11¼	Brighton & Hove Orig	222—227	..	4 19 1
246,320	,,	,,	8¼	Do. A. Ord. Stk.	162—167	..	4 10 10
460,000	20	Sept. 28	10	British	43 44	+½	4 10 11
100,000	Stk.	Aug. 16	6	Bromley, Ord. 5 p.c. .	121—124	..	4 16 9
165,700	,,	,,	4½	Do. do. 3½ p.c. .	91—94	..	4 15 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	12¼—12¾	..	5 9 10
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. .	95—97*	..	4 2 6
150,000	20	July 13	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 28	10	Cape Town & Dis., Ltd.	17—17½	..	5 14 3
100,000	10	Oct. 27	4½	Do. 4½ p.c Pref.. .	10—10½	..	4 5 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	100—102*	..	4 8 3
1,434,680	Stk	Aug. 31	5 5/16	Commercial 4 p.c Stk. .	117—119	+1	4 7 4
560,000	,,	,,	5	Do. 3½ p.c. do. .	113—115	+1	4 6 11
450,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	84—86	..	3 9 9
800,000	Stk.	,,	6½	Continental Union, Ltd.	126—129	..	5 0 9
200,000	,,	,,	7	Do. 7 p c Pref.	143—148	..	4 14 7
424,070	Stk.	—	5½	Derby Con. Stk. . . .	125—127	..	4 6 8
55,000	,,	—	4	Do. Deb. Stk. . . .	108—110	..	3 12 9
486,090	10	July 28	11	European, Ltd. . . .	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	15⅛—16½	+½	5 0 0
15,223,235	Stk.	Aug. 16	4⅛	Gas- light and Coke	4 p.c. Ord. . .	103—104	+1 4 4 7
2,600,000	,,	,,	3⅜		3⅜ p.c. max. . .	89—91	3 16 11
3,799,735	,,	,,	4		4 p.c. Con. Pref.	110—112	.. 3 11 5
4,193,975	,,	Dec. 14	3		3 p.c. Con. Deb.	86—88	.. 3 8 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.		101—103	.. 4 17 1
82,500	,,	,,	6⅔	Do. do. 5 p.c.		123—126	.. 5 3 2
70,000	10	Oct. 13	11	Hongkong & China, Ltd.		19⅜—20½	.. 5 7 4
3,800,003	Stk.	Nov. 15	10	Imperial Continental .		233—235	.. 4 5 1
473,602	Stk.	Aug. 16	3⅜	Do. 3½ p.c. Deb. Red.		96—98	.. 3 11 5
175,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .		123—128	.. 4 13 9
561,000	Stk.	Aug. 16	10	Liverpool United A . .		237—239	.. 4 3 8
718,100	Stk.	Aug. 16	7	Liverpool United B. .		172—174	.. 4 0 6
306,083	,,	Dec. 29	4	L'rpool Unit'd Deb. Stk.		109—111*	.. 3 12 1
75,000	5	Dec. 14	5	Malta & Medn., Ltd. .		4¼—4⅜	.. 5 5 3
560,000	100	Oct. 2	5	Met. of 5 p.c. Deb..		101—103	+1 4 17 1
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.		102—104	+2 4 6 7
541,920	20	Nov. 15	3⅜	Monte Video, Ltd. . .		1.½—12½	.. 5 12 0
1,565,892	Stk.	July 29	4⅜	Newc'tle & G'tesh'd Con.		107—109	.. 4 4 10
406,625	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.		98—100*	.. 3 10 0
15,000	10	Aug. 31	10	North Middlesex 10 p.c.		18½—19½	.. 5 2 7
52,940	1	,,	7	Do. 7 p.c.		13—14	.. 5 0 0
300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .		148—151	.. 5 6 0
600,000	5	Sept. 14	7	Ottoman, Ltd. . . .		6—6⅛	.. 5 7 8
398,490	5	Apl. 28	6	Primitiva Ord. . . .		7—7⅛	.. 4 0 0
796,980	5	July 28	5	Do. 5 p.c. Pref. .		5⅝—5⅞	.. 4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .		97—99	.. 4 0 10
851,070	10	Oct. 13	7	River Plate Ord. . . .		12⅝—13¼	.. 5 5 8
300,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. .		95—97*	.. 4 2 6
250,000	10	Sept. 28	7	San Paulo, Ltd. . . .		13—13⅛	.. 5 3 8
70,000	50	Jan. 2	5	Do. 5 p.c. Deb. .		50—52*	+1½ 4 10 2
135,000	Stk.	Sept. 14	10	Sheffield A		244—246	.. 4 1 4
209,984	,,	,,	10	Do. B		244—246	.. 4 1 4
523,498	,,	,,	10	Do. C		244—246	.. 4 1 4
126,106	Stk.	Aug. 31	5½	Shrewsbury Ord. 5 p.c.		110—120	.. 4 11 8
70,000	10	Sept. 28	10	South African		15½—16⅜	.. 6 1 3
6,250,000	Stk.	Aug. 16	5½	South Met., 4 p.c. Ord.		132—134	.. 4 2 1
1,895,445	,,	July 13	3	Do. 3 p.c. Deb.		87—89	.. 3 7 5
575,000	Stk.	Aug. 16	5½	S'th Suburb'n Ord. 5 p.c.		123—126	.. 4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref. .		125—130	.. 3 16 11
112,533	,,	July 13	5	Do. 5 p.c. Deb. Stk.		132—137	.. 3 13 0
502,310	Stk.	Nov. 15	5	Scuthampton Ord. . .		109—112	.. 4 9 3
120,000	Stk.	Aug. 31	6¾	Tottenham and A 5 p.c.		125—128	.. 4 17 8
363,020	,,	,,	4¾	B 3½ p.c. .		99—102	.. 4 13 2
125,000	,,	Dec. 14	4	Edmonton 4 p.c. Deb.		105—107	.. 3 14 9
182,380	10	Dec. 29	8	Tuscan, Ltd.		9½—10⅝	.. 8 0 0
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.		99—101*	+1½ 4 19 0
30,000	Stk.	Aug. 16	7½	Wands- worth and A 5 p.c. . .		—	.. —
255,636	,,	,,	6¾	B 3½ p.c. . .		137—140	.. 4 9 3
60,000	,,	,,	5 5/16	C 3½ p.c. . .		113—116	.. 4 13 6
57,564	,,	Dec. 29	3	Putney 3 p.c. Deb. Stk.		80—83*	.. 3 12 3
745,872	,,	Aug. 16	5	West Ham 5 p.c. Ord.		106—108	.. 4 12 7
185,000	,,	,,	5	Do. 5 p.c. Pref. . .		123—126	.. 3 19 4
193,300	,,	Dec. 29	4	Do. 4 p.c. Deb. Stk.		102—107*	.. 3 14 9

Prices marked * are "Ex. div."

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ALLIANCE AND DUBLIN CONSUMERS GAS COMPANY. Jan. 16.
BISHOPS STORTFORD GAS COMPANY. Jan. 16.
CROYDON GAS COMPANY. Jan. 16.
LEA BRIDGE GAS COMPANY. Jan. 16.
LOWESTOFT GAS COMPANY. Jan. 30.
SOUTHEND GAS DEPARTMENT. Jan. 30.

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SWANSEA GASLIGHT COMPANY.

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State all Particulars to No. 4524, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SPENT Oxide for Sale (about 30 Tons). Apply for Particulars to DAVID VASS, Engineer and Manager, Gas-Works, AIRDRIE.

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J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

M. LEVY ON INCANDESCENT GAS LIGHTING.
THE attention of Engineers, Contractors, Manufacturers, and others interested in the use of Gas for Lighting, Heating, and Motive Power, is called to the work on "INCANDESCENT GAS LIGHTING," by M. PAUL LEVY, C.E., of Paris, which was noticed in the "JOURNAL" on the 21st of November. It is a large volume of 284 pages, with 127 figures and 8 large plates.
Copies may be obtained at the Office of the "JOURNAL," at the Price of 8s. 6d. each, post free.

FOR SALE.
GASHOLDER, about 20,000 cubic feet capacity. In perfect Working Order, complete with 6-inch Valves and Connections; also 6 Columns with Latticed Girders. Can be seen at work.
Tenders to be sent to R. SEYMOUR TOBEY, Engineer, Horley District Gas Company, Horley, SURREY.

TENDERS are invited for the supply of HEXAGONAL LAMP-COLUMNS, weight 3½ cwt., delivered London from Barge in quantities of 200 or 500, divided over a period of One Year.
Deliveries may be accepted in whole quantities or in Lots of 50; quotations to be in accordance. Submit Drawings and full Particulars, to No. 4531, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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TENDERS are invited for the purchase of this Company's surplus make of TAR delivered in purchasers' Tank-Trucks on the private siding at the Sunninghill Works (L. & S.W. Rly.). Make about 40,000 Gallons.
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THE Swansea Gaslight Company are prepared to receive TENDERS for the purchase of their surplus COKE, for delivery over the next Twelve Months, f.o.b. South Dock, Swansea, or f.o.r.
There is connection with the G.W. Rly., L. & N.W. Rly., Midland Rly., and R. & S.B. Rly.
Also they offer 2000 to 3000 Tons of BREEZE.
THORNTON ANDREWS,
Engineer.
Dec. 27, 1905.

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TENDERS are invited by the above Company for a COVERED SERVICE RESERVOIR, capable of holding about Two Million Gallons, to be constructed on the Company's land at Arkley, in the County of Hertfordshire, in accordance with Plans and Specification which can be inspected at the Company's Offices, Station Road, New Barnet.
Further Particulars can be obtained of the Company's Engineer and Manager, Mr. T. H. Martin, Assoc. M.Inst.C.E.; and copies of the Plans and Specification will be supplied on payment of One Guinea, to be returned upon receipt of a *bonâ-fide* Tender.
Sealed Tenders, to be sent in on or before Ten a.m. on Friday, the 2nd of February, 1906, addressed to the Chairman of the Company, 30, Gracechurch Street, London, E.C.
The Directors do not bind themselves to accept the lowest or any Tender.
T. H. MARTIN, Assoc.M.Inst. C.E.,
Engineer and Manager.
Station Road, New Barnet,
Jan. 5, 1906.

GAS-WORKS FOR SALE.
EDMUNDSONS' FURNISHING AND ENGINEERING CO., LTD., IN VOLUNTARY LIQUIDATION.
THE undersigned is prepared to receive OFFERS for the purchase, as Going Concerns, of either or both of the following GAS-WORKS:—
1.—GAS-WORKS AT WESTPORT, Co. Mayo, Ireland, consisting of Manager's Dwelling House, Coal-Store, Gas-House, Retorts, Purifying Apparatus, Gasholders, 30 feet by 10 feet and 15 feet by 10 feet respectively, Mains, Services, and Meters.
2.—GAS-WORKS AT CARRICK-ON-SHANNON, Co. Leitrim, Ireland, consisting of Manager's Dwelling House, Coal-Store, Gas-House, Retorts and Purifying Apparatus, Gasholder, 30 feet by 12 feet, Mains, Services, and Meters.
Further Particulars can be obtained from
J. HAROLD PIM, F.C.A. (Stokes Bros. & Pim),
Liquidator,
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ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.
MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.
NEW ISSUE OF 2500 £10 ORDINARY SHARES
Ranking for a Standard Dividend of 7 per cent., subject to the Sliding-Scale, the Dividends on similar Shares in the Company having, since 1884, been regularly paid at the rate of 7½ per cent. per annum.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 16, at Two o'clock precisely, in Lots.
Particulars may be obtained at the HEAD OFFICES OF THE COMPANY, in D'Olier Street, DUBLIN, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
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(Supplying Walthamstow and part of Leyton).
NEW ISSUE OF £8000 CONSOLIDATED ORDINARY STOCK,
AND
£2976 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
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Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
BISHOPS STORTFORD AND DISTRICT GAS COMPANY.
NEW ISSUE OF £4000 FIVE PER CENT. PREFERENCE STOCK.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, Jan. 16, 1906, at Two o'clock precisely, in Lots.
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By order of the Directors of the
SOUTHEND GAS COMPANY.
NEW ISSUE OF £13,500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 30, at Two o'clock, in Lots.
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£500 CONSOLIDATED "C" ORDINARY STOCK.
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By order of the Directors of the
LOWESTOFT WATER AND GAS COMPANY.
NEW ISSUE OF 400 ADDITIONAL ORDINARY £10 SHARES,
Ranking for a Maximum Dividend of 7 per cent., equally with similar Shares now receiving 5¼ per cent.; also
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Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of RETORTS and FIRE-CLAY GOODS.
Specification and Quantities, and Form of Tender, may be obtained upon application to Mr. W. Whatmough, Gas Manager.
Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.
Tenders, endorsed "Retorts and Fire-Clay Goods," to be sent to me not later than Tuesday, Jan. 16, 1906.
By order,
GEO. G. BOUCHIER,
Town Clerk.
Municipal Buildings,
Heywood, Dec. 20, 1905.

BOROUGH OF ABERAVON.
(GAS DEPARTMENT.)
GAS MAINS AND METERS.
THE Gas Committee invite Tenders for the supply and delivery of—
Twelve Tons of 3-inch Socket and Spigot CAST-IRON PIPES with grooved Sockets (Coated), each pipe to weigh 1 cwt. 0 qr. 8 lbs.
Six Tons of 4-inch Socket and Spigot CAST-IRON PIPES with grooved Sockets (Coated), each pipe to weigh 1 cwt. 1 qr. 19 lbs.
Also for the supply of DRY GAS-METERS (ordinary) required during Twelve Months ending Jan. 31, 1907.
Any further Particulars to be obtained of Mr. A. J. Bond, Manager.
Tenders, endorsed "Tender for Mains, &c.," to be delivered to the undersigned not later than Monday, the 15th inst.
The Committee do not bind themselves to accept the lowest or any Tender.
By order,
M. TENNANT,
Town Clerk.
Jan. 6, 1906.

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AN
ANALYSIS OF THE ACCOUNTS
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AND OF THE
ACCOUNTS OF SOME OF THE PRINCIPAL
PROVINCIAL WATER UNDERTAKINGS
FOR THE YEAR 1904-1905.
Compiled by
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Chartered Accountants.
LONDON:
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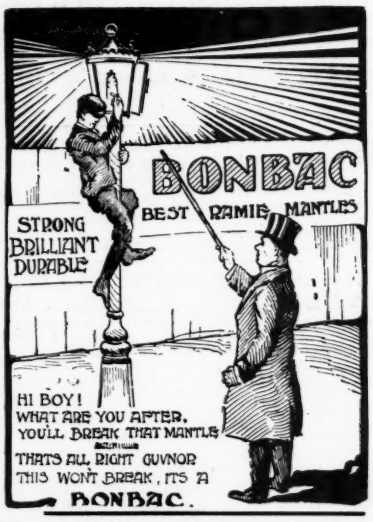
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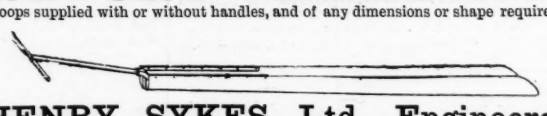

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Illustrated Advertisement, with full Particulars, in "JOURNAL" for April 4, 1905, p. 66.

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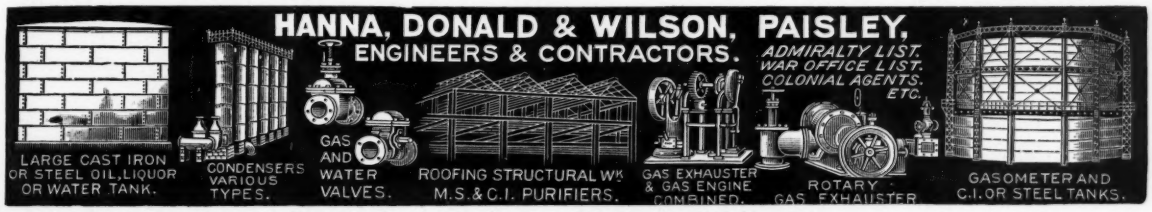
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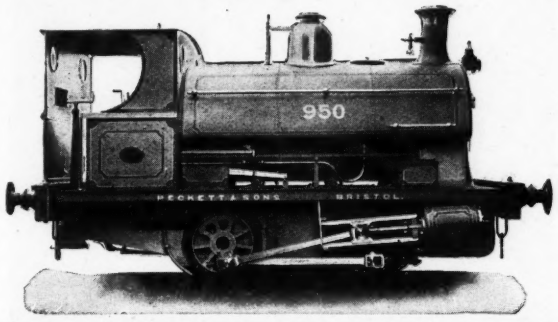

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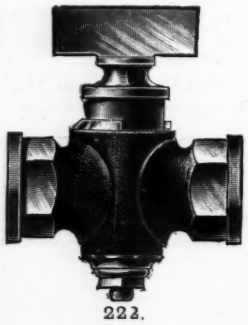
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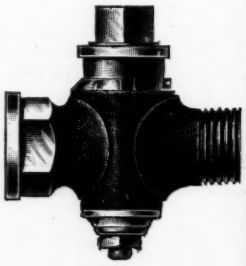
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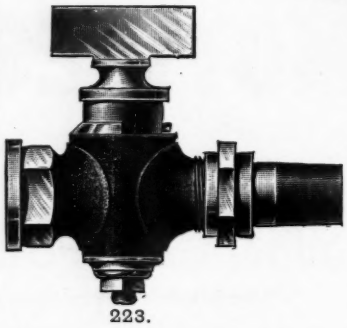
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your taste or your requirements, but we do know that the "K" Inverted Burner possesses qualities not possessed by any other: Simplicity and *freedom from trouble of any kind*, a brilliant light of 80 Candles for 3 to 3½ feet of Gas, cheap in first cost, and well-made. Do these characteristics appeal to you? If so, the "K" Burner will interest you.

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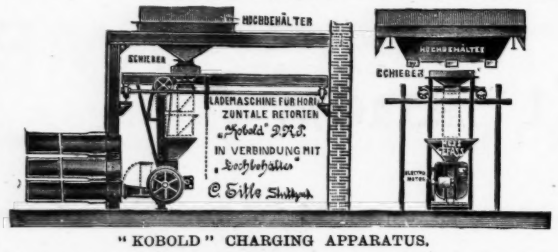

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ADVANTAGES OF THE "KOBOLD" CHARGING APPARATUS.

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3.—Uniform bed of coal of any desired height in the retort, and consequently any desired weight of charge may be inserted.
4.—Greater yield of gas in comparison with all other types, owing to the coal being deposited in the retort most advantageously.
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6.—Smallest consumption of power.
7.—Most rapid working, as the complete charging of a retort requires only two pulls of a lever.
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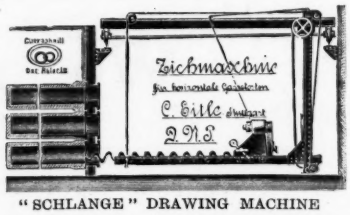

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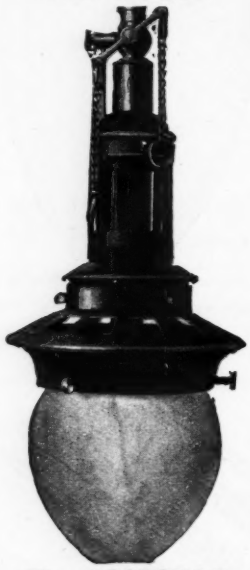

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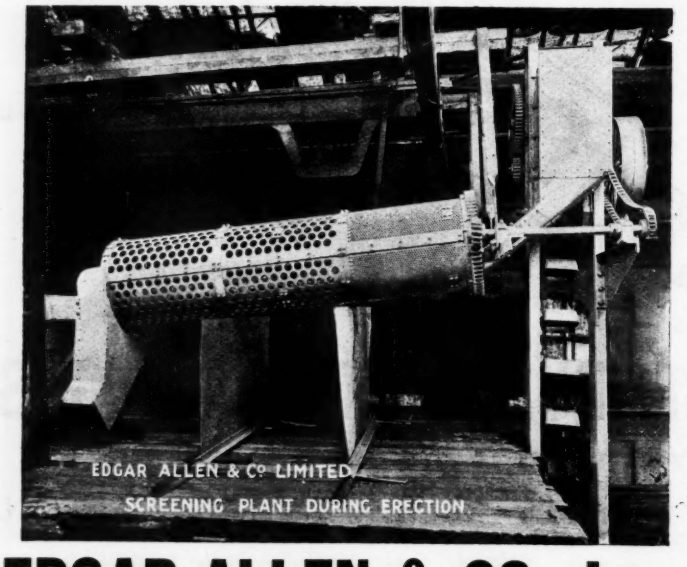

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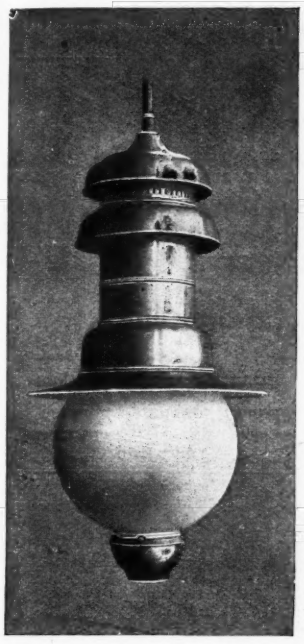
Lamp with Globe up ready for use.



FOR EXTERIOR LIGHTING.

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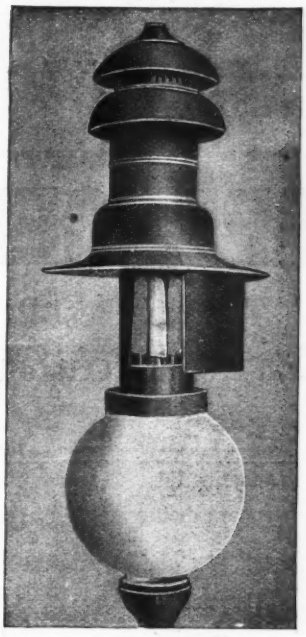
Globe lowered, showing wind-proof shield with door open for access to Mantles. Bottom cup can be removed for Globe cleaning.



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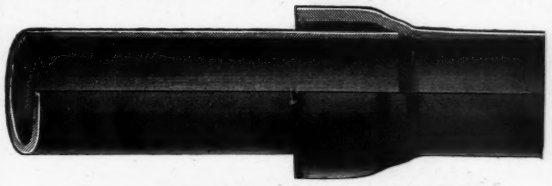

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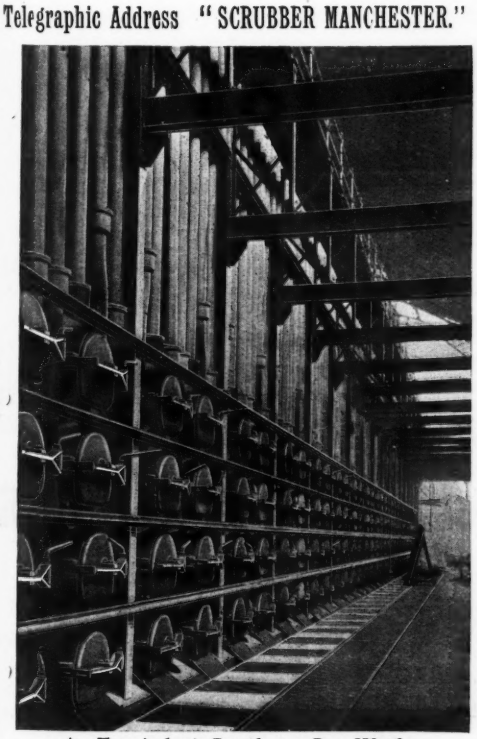

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